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THE EFFECTS OF TRADE AND EXCHANGE RATE POLICIES ON AGRICULTURE IN ZAIRE

Tshikala B. Tshibaka

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FOREWORD

The International Food Trade and Food Security Program at IFPRI has undertaken a series of country studies on trade and exchange rate regimes and how they affect agricultural incentives in developing countries.

This major research thrust was prompted by the global economic turbulence experienced in the past decade. Oil price shocks, rapid inflation, and sharp fluctuations in food prices are only some of the symptoms of this turbulence. The desire to develop their industrial sectors and the availability of low real interest rates encouraged many developing countries to borrow more than they could easily repay, which has led to grossly overvalued exchange rates. The extent to which this overvaluation has discriminated against agricultural exports and agriculture in general is a question that is receiving increasing attention among researchers and policymakers alike.

In addition to this study on Zaire, other studies in this series have included *The Effects of Exchange Rates and Commercial Policy on Agricultural Incentives in Colombia: 1953-78,* Research Report 24, by Jorge García García; "Coffee Boom, Government Expenditure, and Relative Prices in Agriculture: The Colombian Experience," also by Jorge García, with Gabriel Montes; *Agriculture and Economic Growth in an Open Economy: The Case of Argentina,* Research Report 36, by Domingo Cavallo and Yair Mundlak; and most recently *The Effects of Trade and Exchange Rate Policies on Agriculture in Nigeria,* Research Report 55, by T. Ademola Oyejide. Research is under way for country studies on the Philippines, Chile, Peru, and Thailand.

The complete series of studies will be presented at an IFPRI policy workshop planned for 1987. They will provide a broad view of how trade and exchange rate policy influences agricultural growth in developing countries, supported by quantitative data on relative effects.

This research effort, a part of that series, focuses on Zaire, a major mineral exporter. Because the mineral sector is regarded as the engine of the economy, the attention directed to it has detracted from the competitiveness and growth of other sectors, agriculture in particular. These problems have been compounded in Zaire by domestic policies aimed at rectifying a deteriorating balance of payments.

Tshikala Tshibaka came to IFPRI from the Institut Facultaire des Sciences Agronomiques in Yangambi, Zaire. Specialized issues such as exchange rates and relative prices must be analyzed in a broad context if the analyses are to be useful. Tshibaka brings a special talent and experience to this kind of analysis of the Zairian economy.

This study was partially funded by the Ford Foundation's office in Lagos, Nigeria, and by the International Development Research Centre of Canada. IFPRI is particularly grateful to these two organizations for their encouragement and support of this work on Sub-Saharan Africa.

John W. Mellor

Washington, D.C.
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I present my deep appreciation to John W. Mellor for his interest and encouragement at every stage of this research, and to Alberto Valdés, project leader, for valuable interactions and discussions. I am also indebted to Romeo Bautista and T. Ademola Oyejide for their comments on an earlier draft. The able computer assistance of Suzanne Gnaegy also is appreciated. Finally, my greatest debt is to the members of my family, specifically to my wife, Tshibola wa Kazadi, who selflessly endured alone the burden of maintaining our family in Zaire.

1

SUMMARY

Trade, exchange rate, and other price policies adopted by Zaire since 1960 have negatively affected the agricultural sector. Because farming is the major source of employment and food and its contribution to both GDP and foreign exchange earnings is large, the overall economy also has been seriously affected.

This study covers not only policies directed specifically to agriculture but also those enacted to assist other sectors. Policies directed at nonfarm sectors may have more effect on agricultural incentives than those explicitly aimed at the farm sector.

However, because the study is based on official time series data, it is restricted to the formal sector of the economy. Accurate data on the parallel sector of the economy—unofficial trade and marketing activities—are unavailable. Thus the picture presented is not comprehensive but only indicative of the effects of economic policies on agriculture and the economy as a whole.

The centrality of the real exchange rate in the economic development process is emphasized. A falling real exchange rate (domestic terms of trade of foreign exchange with respect to nontradable goods) makes exportable goods less profitable. This leads producers of both farm and nonfarm exports to divert resources to other activities. As a result, the export sector contracts, and the ability of the country to earn enough foreign exchange is reduced. In addition, outflow of capital is encouraged.

This creates a precarious situation. The limited foreign exchange earnings available restrict imports not only of consumer goods but also of capital and intermediate goods. Limited import capacity affects the productive capacity of the economy because investment in development of human resources and infrastructure is constrained. The impact will be greatest on the farm sector, but the economy as a whole will be severely affected. If the trend is not reversed through appropriate real exchange rate management, long-term development of all sectors will be jeopardized.

The Zairian economy has gone through three distinct phases since 1960. The 1960-65 period was marked by political crises and economic disorders. Major policy measures adopted in 1961 to restrain a deteriorating balance-of-payments position included an increase in import duties, import licensing, a 28 percent devaluation of the domestic currency, and foreign exchange controls. However, complementary policies such as investment, credit, price, and income distribution measures were not instituted, and the deterioration continued.

A second reform in 1963 introduced a dual exchange rate system, which resulted in devaluations for imports of raw materials and capital goods as well as consumer goods and exports. In addition, credit to the private sector and salary increases were restricted. Civil war broke out in 1962, before the reforms could take effect, and farm output as well as overall economic activity declined. Staple food crop output grew only 1.8 percent per year in 1961-65 compared with 3.8 percent for the population growth rate. Output of major export crops fell at an annual rate of 9.4 percent.

Recovery in 1966-70 was hastened by an influx of significant international aid and the adoption of less restrictive trade and exchange rate policies. Annual rates of output rose 4.0 percent for staple foods and 8.9 percent for major export crops. GDP grew by 6.4 percent.

Restrictive trade and exchange rate policies were again adopted in 1971-82 to deal with balance-of-payment and budget deficits. But basic economic indicators continued to decline. The annual rate of growth of staple food crops fell to 1.6 percent, that of major export crop output to 0.8, and that

of GDP to 0.4 percent. The real exchange rate increased 0.8 percent annually during 1966-70 but fell 0.6 annually during 1971-82, which contributed to the declining performance of the farm sector and the overall economy.

All major crops were taxed during 1971-82 except rice and palm oil. Rates of taxation were, in decreasing order, highest for cotton, coffee, groundnuts, and maize. Overall, export crops were discriminated against more than food crops. The extent of taxation or subsidy suggests that the agricultural sector was discriminated against. There also appears to be a conflict between food and export crops in production. A change in relative prices affects the food-export crop mix.

The effects of trade and exchange rate policies on relative prices have a substantial impact on the structure of incentives. The domestic price of farm and nonfarm nontradable goods relative to all exportables would increase by about 0.52 percent as a result of a 1 percent rise in the domestic price of all importables relative to all exportables.

This result implies that in Zaire, a uniform (average) tariff of, say, 10 percent on all imports is equivalent to a tax of 5.2 percent on all exports. This further implies that at least half of the burden associated with protection of importables against foreign competition is borne by farm and nonfarm exportable goods. Moreover, when the direct tax imposed on exportable commodities is added to this indirect tax, the level of total taxation of exportable commodities is much higher than intended by policymakers. The resulting squeeze on the export sector makes it hard for it to generate enough foreign exchange to meet the import requirements of both farm and nonfarm sectors.

Clearly, protection aimed at encouraging import substitution will, in the last resort, also impede expansion of import-competing activities. A uniform treatment of both importables and exportables would help Zaire take advantage of its large agricultural and mineral resources. Uniform treatment means the same level of effective taxation on all tradables. Thus, government revenue objectives could be obtained while affecting all sectors of the economy neutrally.

2

AGRICULTURE IN ZAIRE

The agricultural sector of Zaire has two basic components: traditional and modern plantation agriculture. Traditional agriculture is handled by peasant farmers who rely mostly on household labor, which is the main determinant of production. The capital available is almost negligible and is composed largely of hand tools and seeds from previous crops. Land is abundant overall and access to it not a constraint, but the cultivated area per household rarely exceeds one hectare in the forest zone and two hectares in the savannah region. The limited amount of capital and the pattern of labor allocation among household activities (farm, nonfarm, economic, domestic, and sociocultural) seem to be the chief constraints to an increase in cultivated areas in the peasant sector.[1]

Technological change occurs so slowly in peasant agriculture that it is hardly noticeable. Shifting cultivation continues to be the most prevalent method of production, except in areas in the eastern and western parts of the country where population growth has increased pressures and led to more intensive use of arable land.

Plantations are owned mainly by large foreign-owned corporations, though some are owned by Zairians. Output depends on both paid labor and capital. Because of the use of machinery, processing plants, and intermediate producer goods, the share of capital in plantation agriculture is much higher than in peasant farming.

Plantation agriculture produces entirely for market, whereas peasant agriculture produces for both farm household consumption and the market. Nearly all of the food crops, cotton, and groundnuts are produced on peasant farms. In some areas of the country, peasant farmers also produce some coffee and palm oil, which are largely if not totally sold in the domestic market. The bulk of export crops such as coffee, cocoa, rubber, tea, and palm oil is produced on plantations.

Importance of Agriculture

Zaire is relatively well endowed with natural resources. Because its mineral deposits have tended to overshadow its agricultural resources, policymakers have paid relatively little attention to agriculture and have regarded mining as the engine of economic growth. Despite this view, agriculture remains a mainstay of the Zairian economy and the growth of other sectors is largely dependent on it.

About 75 percent of the population lives in rural areas, and at least 80 percent of the labor force is engaged in agriculture. Nevertheless, agriculture's contribution to GDP has been only about 40 percent during the entire postindependence period.[2] An objective of this study is to determine whether agriculture's relatively small share of GDP is an indicator of structural transformation of the economy or is a result of policies that have slowed its growth.

The share of the farming sector in foreign exchange earnings, which amounted to 38.9 percent in 1959, fell to 16.0 percent during the 1971-81 period.[3] The overwhelming share of export earnings was contributed by mining. This has been a key variable

[1] See Tshikala B. Tshibaka, "Economic Analysis of Rice Production in the Zairian Basin," International Food Policy Research Institute, Washington, D.C., 1986 (mimeographed).

[2] Banque Nationale du Zaire (Congo), *Rapport Annuel* (Kinshasa: Banque Nationale du Zaire [Congo], various years).

[3] Ibid.

used by Zairian policymakers in ranking the potency of different sectors in promoting overall economic growth.

Performance of Agriculture

Growth of Farm Output

Agricultural output in Zaire has gone through three distinct periods of growth since the country gained its independence on June 30, 1960. The 1960-65 period was characterized by a decline, mainly explained by the violent political strife that led to the destruction of the preindependence economic infrastructure.

Table 1 shows that during 1961-65 total cereal production dropped an average of 3.7 percent per year and groundnut output 1.5 percent, but production of roots, tubers, bananas, and plantains grew at an annual average rate of 2.7 percent. Aggregate production of these staple foodstuffs grew 1.8 percent a year, which was far below the 3.8 percent rate of population growth.

Recovery was rapid during 1966-70, when total output of staple food crops grew at an annual average rate of 4.0 percent and that of major export crops at 8.9 percent.[4]

Since the recovery period, 1971-82, the performance of the farming sector has not been encouraging. The annual average growth rate of staple food crop output dropped to 1.6 percent, much lower than the estimated population growth rate of 2.8 percent. The export crop subsector was affected the most during 1971-82. Aggregate major export crop output grew at an annual average rate of 0.8 percent, with palm kernels, natural rubber, cocoa beans, and palm oil declining.

Coffee farming followed a different pattern. Its annual rate of output growth, which was 3.3 percent during the crisis period, increased to about 7.1 percent during the recovery and then fell to 2.4 percent in the postrecovery period. The reason is not clear. However, it may have been because most of the coffee plantations are in eastern and northeastern border areas, which facilitated smuggling to avoid price controls, taxes, and overvalued exchange rates.[5]

Cotton is the only export crop that is solely produced by peasant farmers. Through the Société de Textiles Cotonnière (SOTEXCO), which was created in 1976, the government effectively applied a number of measures, mainly coercive, to push farmers to produce more cotton to meet the demand of newly established textile plants. Production increased about 6.7 percent per year during 1976-82. During the entire 1971-82 postrecovery period, cotton output grew at an annual rate of only about 0.7 percent.

Exports and Imports

The substantial decline in the volume of crop exports during 1961-65 was mainly the result of political events. It was followed by a sharp increase in the recovery period and then another decline. Palm oil and palm kernel oil exports declined at a rate of 25.8 percent and 9.2 percent during 1971-82, while exports of natural rubber decreased at an annual rate of 4.5 percent and cocoa bean exports at 2.3 percent. Cotton disappeared completely from the export list in 1977.

Increased food imports are additional evidence of the poor performance of the agricultural sector. During the recovery period, the volume of food imports increased at an annual rate of 2.1 percent, but the rate jumped to 7.2 percent during the postrecovery period, when overall imports were contracting at an annual rate of 5.9 percent (see Appendix 1, Table 8).

Although the share of food imports in the total import bill remains relatively small, it has been rising. During 1966-70 cereals were about 3.3 percent and other food items 4.4 percent of the total imported. These shares rose to 8.0 percent for cereals and 6.3 percent for other food items during 1971-81. However, the degree of food import dependency in Zaire is still low (Appendix 1,

[4] This impressive rate of growth of export crop output is explained by its low level in 1965, following the Civil War.
[5] World Bank, *Country Study: Zaire* (Washington, D.C.: World Bank, 1980).

Table 1—Growth of agricultural output and exports by crop, 1961-82

Crop	1961-65		1966-70		1971-82	
	Output Growth	Export Growth	Output Growth	Export Growth	Output Growth	Export Growth
	(percent)					
Staple food crops	1.8	...	4.0	...	1.6	...
Cereals	-3.7	...	9.1	...	2.8	...
Nongrain food	2.7	...	2.2	...	1.9	...
Pulses (groundnut)	-1.5	...	8.4	...	1.7	...
Major export crops	-9.4		8.9		0.8	...
Palm oil	-13.5	-17.0	12.8	49.6	-1.1	-25.8
Green coffee[a]	3.3	-9.7	7.1	28.7	2.4	8.2
Palm kernel	-10.9	-7.2	12.5	10.5	-5.2	-9.2
Natural rubber	-12.2	-11.8	10.3	10.5	-1.4	-4.5
Cotton	-21.2	-27.1	23.2	...	0.7	...
Cocoa beans	-8.6	-8.6	9.0	5.9	-1.2	-2.3

Sources: Derived from data in Food and Agriculture Organization of the United Nations, "FAO Food Balance Sheets, 1961-65 Average to 1977," Rome, 1978 (computer printout); and Food and Agriculture Organization of the United Nations, *FAO Production Yearbook*, various issues (Rome: FAO, various years).

Notes: Cereals include maize, rice, sorghum, and millet. Nongrain food includes cassava, sweet potatoes, bananas, and plantains.

[a] Export growth refers to robusta coffee only, whereas output growth refers to both robusta and arabica.

Table 9). During 1966-70 production of staple food crops accounted for 96.2 percent of the domestic supply, with the remainder filled by cereal imports.[6] The volume of staple food crop output in the domestic supply dropped to 93.8 percent during 1971-81 (Appendix 1, Table 10).

According to trade data, the food import bill averaged 9.5 percent or less of total export earnings during 1971-81. In 1976, however, food imports were equivalent to 20.0 percent and in 1978 to 17.5 percent of total export revenue (Appendix 1, Table 11). These high ratios may be explained by a large increase in the food import bill and a substantial drop in export revenues, mainly as the result of a fall in world copper prices.[7] These are, of course, events over which the Zairian government had little control, except for reducing the volume of imports.

The ability of export agriculture to finance food imports proved to be limited. The food import bill, which represented 43 percent of crop export earnings during 1966-70, claimed nearly 70 percent of agricultural export earnings during 1971-81.

The Food Supply Situation

Even though Zaire's domestic food crop production provides a large share of the domestic food consumed, and dependency on food crop imports is still low, Table 2 shows that the total staple food supply has been declining since 1966-70. As pointed out earlier, the annual rate of growth of the staple food crop supply was far below the rate of population growth during the period.

This situation has created hardships for many of the people of Zaire. A 10-year field study on nutrition and health reveals that malnutrition has been spreading rapidly. Average calorie intake was 80 to 90 percent

[6] The share of the food output in the domestic food supply measures the extent of food self sufficiency in a country. It is formally given by the expression: $fs = Q/(Q + M - X)$, where Q is the domestic food output and M and X are the quantities of food imported and exported, respectively.

[7] World Bank, *Country Study: Zaire*, p. 27.

Table 2—Annual average growth rate of staple food supply, 1961-81

Period	Annual Average Growth Rate of Staple Food Crop Output	Annual Average Growth Rate of Cereal Imports	Annual Average Growth Rate of Total Staple Food Crop Supply
		(percent)	
1961-65	1.8	35.0	2.3
1966-70	4.0	11.2	4.1
1971-75	2.4	5.2	2.0
1976-81	1.1	14.8	1.6
1971-81	1.6	10.4	1.8

Sources: Derived from data in Food and Agriculture Organization of the United Nations, "FAO Food Balance Sheets, 1961-65 Average to 1977," Rome, 1978 (computer printout); Food and Agriculture Organization of the United Nations, *FAO Production Yearbook*, various issues (Rome: FAO, various years); International Food Policy Research Institute, "Food Aid Tape," Washington, D.C., 1981; and Zaire, Institut National des Statistiques, *Annuaires Statistiques* (Kinshasa: Institut National des Statistiques, various years).

of minimum requirements.[8] This suggests that food production and food imports fell short of meeting growing food needs.

The fact that the food import bill was low relative to export earnings suggests that enough agricultural capital and intermediate goods could have been imported to boost domestic food production sufficiently to fill the gap between supplies and requirements. However, the composition of imports shows that a large share of export earnings was allocated to imports of nonagricultural capital and intermediate goods needed for the industrialization program and expansion of the mining sector. This was in line with the government's economic development strategy, in which industrialization was a key element even though agriculture was long ago proclaimed to have top priority.

In summary, 1961-65 was marked by serious political disorders that led to a fall in economic activity. This situation was reversed during 1966-70, when the economy as a whole and agriculture in particular performed quite well. But during 1971-82, the farming sector contracted. This has significantly contributed to the contraction of the overall economy.

[8] Ibid., pp. 24-25.

3

ZAIRIAN ECONOMIC POLICIES

Accelerated economic development through industrialization has been the main economic goal of Zairian policymakers during the post-independence period. A wide range of economic policy instruments has been used. The role of agriculture has been to provide cheap basic food and to contribute to foreign exchange earnings needed to import industrial capital goods and raw materials. Some of the economic policies that have been enacted were specific to agriculture while others were broader in scope and in some cases apparently unrelated to agriculture.

Macroeconomic Adjustment Policies: An Overview

The first major policy measures after independence were taken in November 1961. They included an increase in import duties, import licensing, a 28 percent devaluation of the local currency, and exchange controls. The main objective was to restrain a deteriorating balance-of-payments position.[9] However, complementary policies such as investment, credit, price, and income distribution policies were not instituted. Consequently, the balance of payments continued to deteriorate.[10]

A second reform in 1963 introduced a dual exchange rate system. A rate of 0.081 zaire (Z) to U.S. $1.00 was to be used for imports of producer goods, and a rate of Z 0.165 to U.S. $1.00 was to be used for imports and exports of consumer goods.[11] These were devaluations of 26.6 percent and 157.8 percent, respectively. Simultaneously, a ceiling was established on credit granted to the private sector. Salary increases were restricted. Unfortunately, this reform did not have enough time to work as civil war broke out in the country. From 1964 a single foreign exchange rate was applied to all import and export activities. A political crisis led to a military coup in November 1965.

A third reform in 1967 included reduction of the government deficit by increasing receipts and cutting public expenditures, devaluation of the currency corresponding to a 201.8 percent increase in the official exchange rate (expressed as number of units of local currency per unit of foreign currency), reduction of exchange controls, limitation of salary increases, and restriction of the increase in credit accorded to the private sector. The Banque Nationale du Congo notes that the immediate results of this reform were favorable. Foreign exchange earnings increased substantially from both the farming and mining sectors. The foreign exchange reserve also increased.[12] Gross domestic output increased at an annual rate of 6.4 percent, total output of staple food crops at 4.0 percent, and major export crops at 8.9 percent during 1966-70. Undeflated export earnings from agriculture and mining rose at annual rates of 9.4 percent and 22.0 percent during this period.[13]

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[9] K. M. Cleaver, "The Effective Rate of Subsidy and Resource Allocation in Zaire" (Ph.D. thesis, Tufts University, Fletcher School of Law and Diplomacy, 1975), pp. 4-7.

[10] Banque Nationale du Congo, *Rapport de 1963* (Kinshasa: Banque Nationale du Congo, 1964).

[11] Congolese francs were the currency until 1967, when a new currency, the zaire (Z), was adopted. Francs were converted to zaire at the rate of 1,000 Congolese francs for Z 1.00 (International Monetary Fund, *Financial Statistics Yearbook* [Washington, D.C.: IMF, 1979]).

[12] Banque Nationale du Congo, *Rapport de 1967* (Kinshasa: Banque Nationale du Congo, 1968).

[13] Food and Agriculture Organization of the United Nations, *FAO Production Yearbook*, various issues (Rome: FAO, various years); and International Monetary Fund, *International Financial Statistics Yearbook, 1984* (Washington, D.C.: IMF, 1984), p. 625.

The real value of the local currency in terms of foreign exchange began to deteriorate in 1969, resulting in the progressive reimposition of restrictions on imports and foreign exchange transactions. The current account, which was positive during 1966-69, became negative in 1970 and continued to deteriorate and so did the real value of the domestic currency in terms of foreign exchange. From 1970 to 1975 the current account deficit increased at an average annual rate of 60.0 percent, while the difference between the parallel market and official exchange rates grew at an average rate of 70.8 percent per year (Appendix 1, Table 12). The Zairianization (nationalization) measures taken in November 1973 also contributed to this situation.[14]

In 1976 new import and foreign exchange restrictions were introduced and the local currency was devalued by 58.4 percent. Despite these efforts economic difficulties mounted. The current account deficit rose from U.S. $592.7 million dollars in 1975 to U.S. $803.2 million in 1976, and the domestic inflation proceeded at much higher rates than the international. The overall government budget deficit reached a record of Z 310.0 million in 1976.

In early 1977 the Zairian government increased the taxes on exports other than those of the Générale Carrière de Mines (GECAMINES) in order to reduce the budget deficit from Z 310.0 million to Z 175.0 million in 1977. The World Bank notes that average taxes on exports other than those of GECAMINES increased significantly in 1977, following introduction of a tax on coffee exports so high that it resulted in substantial underreporting and smuggling.[15]

Despite a sharp drop in imports, the current account deficit in 1977 hit the U.S. $1,451.3 million mark. In addition to declining copper prices, the failure to fully repatriate export earnings, especially from coffee, and a sharp decrease in net capital inflows contributed to this deficit. The 1977 stabilization program has had little or no impact on stabilizing the economy.

In 1978, adjustments were made in key policy areas such as the exchange rate, interest rates, and producer prices—all crucial for stimulating production, exports, diversification, employment of local resources, savings, investment, and repatriation of capital. Measures taken included the devaluation of the zaire in the International Monetary Fund's (IMF's) special drawing rights (SDRs) by 50 percent between November 1, 1978 and January 2, 1979, and by another 25 percent on August 24, 1979; the reorganization of the customs service and public corporations; and efforts to improve tax collection, the allocation of foreign exchange, the administration of the government payroll, and the investment selection process.

These measures were often insufficient or undertaken too late and in an uncoordinated fashion. In fact, 1978 was the worst year of the crisis. Output was about 17 percent below and import volume about 50 percent below 1974 levels, and 20 percent below that of 1970. The budget deficit was equivalent to 9 percent of commercialized GDP. The inflation rate from December 1977 to December 1978 averaged close to 100 percent.

In September 1983 another adjustment program was enacted. A number of far-reaching economic and financial measures were taken, the most important of which were: immediate devaluation of the zaire by 77.5 percent vis-à-vis the SDR; introduction of a transitional dual exchange rate regime, leading to the unification of the two rates in February 1984 and the floating of the rate thereafter; a substantial liberalization and simplification of the exchange and trade system, including a comprehensive revision of customs duties; and decontrol of most prices, including agricultural producer prices, and interest rates.

Although the situation remained difficult in 1983, the GDP expanded by more than

[14] World Bank, "Zaire Economic Memorandum," Report 2518-ZR, Washington, D.C., October 19, 1979.
[15] World Bank, *Country Study: Zaire*, p. 66.

1 percent in real terms as the result of some recovery in mining production, particularly diamonds and petroleum. The favorable impact of the devaluation on government revenues together with restraint in expenditures helped to reduce the budgetary deficit to about 4 percent of the marketed GDP.[16]

Changes in trade, exchange rate, and other economic policies were erratic, which may have introduced uncertainty not only in trade but also in the economy as a whole. In sum, these policy changes helped shape the structure of incentives for both farm and nonfarm sectors.

Trade Policies

Taxes on imports and exports continue to be the most important trade policy instrument used by the Zairian government. In addition, quantitative restrictions also have been applied. During 1970-78, the share of taxes on international trade and transactions in the Zairian government revenue was relatively high but has been declining. The average annual share of these taxes was about 52.6 percent of the total government budgetary revenue during the 1970-78 period. It represented 63.9 percent of the budgetary revenue in 1970 but dropped to about 28.5 percent in 1978.[17]

However, the decline in the share of import and export taxes in the government revenue was to a large extent due to a growing weakness in tax administration and an increase in tax evasion.[18] The ratio of import taxes to import value declined from 25 percent to 20 percent and that of export taxes to export value from 34 percent to 14 percent during 1970-77 (Table 3).

The fall in the share of export taxes was more pronounced, largely because of GECAMINES' financial problems and the tax rebate the company received. The ratio of export taxes to export value dropped from 32 percent in 1974 to 14 percent in 1977. Average taxes on exports other than those of GECAMINES increased significantly in 1977, following the introduction of a new tax on coffee exports. However, substantial underreporting of coffee exports prevented a greater improvement. The high premium from exporting at the parallel market rate and evading taxation constituted a powerful incentive for smuggling and underinvoicing of coffee exports during 1976-77. For example, in 1976 the declared unit value of exports of the commodity was only 42 percent of the world market price. This implied a loss in foreign exchange earnings due to underinvoicing alone (ignoring smuggling) of about U.S. $175 million. In 1977, when the tax on coffee exports yielded only U.S. $35 million, the loss would have been in the order of U.S. $110 million.[19]

Despite growing weakness in tax administration and an increasing tax evasion, the share of import and export taxes and duties in government budgetary revenue suggests that trade policy was, in addition to exchange rate policy, an important component of economic policies initiated during the period under study.[20]

Price Control and Marketing Arrangements

The Zairian government has always attempted to control all agricultural prices, a policy that was inherited from the colonial period. According to government officials, it helps protect both farmers and consumers against unscrupulous middlemen. Official producer prices of agricultural products have consistently been far below those in

[16] World Bank, "Zaire Economic Memorandum."

[17] Ibid.

[18] Banque Nationale du Zaire, *Rapport Annuel 1979* (Kinshasa: Banque Nationale du Zaire, 1980).

[19] World Bank, "Zaire Economic Memorandum."

[20] It is important to stress that the use of officially specified tax rates on imports and exports is not very helpful in analyzing the effects of trade regime. The prevailing prices of tradables and nontradables are more useful because the effects of trade, exchange rate, and other price policies are taken into account.

Table 3—Import and export tax performance indicators, 1970 and 1974-77

Tax	1970	1974	1975	1976	1977
Import taxes[a]	0.250	0.226	0.209	0.217	0.206
Export taxes[b]	0.343	0.318	0.222	0.135	0.143
GECAMINES[c]	0.428	0.432	0.264	0.117	0.046
Others[d]	n.a.	0.087	0.146	0.137	0.184

Sources: Unpublished data provided by the Banque du Zaire and Department of Planning, Zaire.
Note: GECAMINES is the Générale Carrière des Mines.

[a] Import tax figures are the ratio of import taxes to import value, based on merchandise imports financed with domestic resources.
[b] Export tax figures are the ratio of export taxes to export value, based on merchandise exports (f.o.b.)
[c] Export tax figures for GECAMINES are the ratio of export taxes paid by GECAMINES to GECAMINES' export earnings.
[d] Export tax figures for others are the ratio of export taxes other than GECAMINES to export earnings generated by others.

either domestic parallel markets or in the world market.

The bulk of marketed food is sold in domestic parallel markets. For instance, in Turumbu area, where producing areas are poorly connected to urban areas in the Zairian Basin, the 1981 average farm-gate price of paddy rice was Z 3,609 per metric ton compared with official prices of Z 800 per metric ton, while that for maize was Z 1,170 per metric ton as opposed to Z 650 per metric ton.[21] An exception is project areas where farmers are administratively compelled to sell their products at official prices. This, among other things, might have contributed to the lack of interest by farmers in government-sponsored projects, which have had little or no impact on the growth of food production. One case in point is the Kanyama-Kasesa maize project in the Shaba province.

The impact of government policies on agricultural exports varies by crop. Cotton, produced exclusively by peasant farmers, has no parallel domestic market outlet. A handful of companies linked with the domestic textile industry collect, process, and market cotton. Almost all peasant farmers are far from the border areas so there is little opportunity for them to smuggle cotton to avoid price controls, taxation, and overvalued exchange rates. The impact of any government policy directly or indirectly designed for cotton will be fully transmitted to producers.

Palm oil is produced in both peasant and plantation agriculture. The parallel domestic market is large. Production by peasants and a significant portion of that from plantations are sold in the domestic parallel market. Smuggling of palm oil to neighboring countries cannot be totally ruled out, but is probably limited. Consequently, the effects of government policies were partially transmitted to producers.

Domestic consumption of coffee, cocoa beans, and natural rubber is limited. Peasant farmers who produce coffee and cocoa beans tend to sell a large share of their output to licensed exporters at the official prices. These exporters, some of whom were producers, are able through smuggling or underreporting to avoid government controls.[22] However, the extent of smuggling and underreporting is hard to determine. A cross-examination of trade and output data from Zairian official and international sources indicates that the amounts involved are fairly small.

Appendix 1, Table 13 shows that Zairian

[21] Muamba Tshuinza, "Allocation et Utilisation des Ressources dans l'Agriculture Traditionelle: Cas de la Collectivité Rurale Turumbu," Institut Facultaire des Sciences Agronomiques, Yangambi, Zaire, 1983; and information provided by Zaire, Département de l'Agriculture, 1982.
[22] World Bank, *Country Study: Zaire.*

official records of crop exports compare favorably with those from international sources. The most serious problem is not the recording of international transactions but the repatriation of foreign exchange from crop exports. Because most crop exporters have a high degree of leverage, they tend to withhold a substantial amount of foreign exchange earnings outside the country to avoid taxation and the overvalued exchange rate of the domestic currency.[23] This practice, by limiting the availability of foreign exchange, has a negative impact not only on agriculture but also on the rest of the economy. This situation was partly corrected by the policy reform initiated in September 1983. Since then, producers have been free to set their prices. In addition, the power of local authorities to fix prices and to restrict domestic regional trade was suspended. Some restrictions remain on the domestic prices of manufactured goods, which can be adjusted freely but must conform to the "cost of production plus 20 percent" formula and are subject to ex-post price controls. The government continues to intervene directly in price determination only for petroleum products, public utilities, and domestic public transport.[24]

Other Government Policies

The Zairian government expenditure and credit policies were financed by an increasingly large fiscal deficit, particularly during 1971-81. The deficit moved from Z 10.7 million a year during recovery to Z 400.8 million a year during 1971-81. And government consumption rose from Z 150.8 million a year during 1966-70 to Z 1,218.2 million a year during 1971-81 (Appendix 1, Table 14). The government's account expenditures far outstripped its capacity to raise additional revenue, requiring borrowing, largely from the Central Bank.

The Bank of Zaire has expanded domestic credit and the money supply by creating claims on government. During 1966-70, domestic credit and the money supply increased at annual rates of 10.1 percent and 20.2 percent, while claims on government rose at an annual rate of 20.8 percent. However, between 1971 and 1982, when the deficit in the government account increased rapidly, the Bank of Zaire increased the claims on government at an annual rate of 34.2 percent. Domestic credit rose at an annual rate of 33.7 percent and the money supply by 30.2 percent, thus adding fuel to external inflationary influences. Rates of inflation in the economy were very high during this period (Appendix 1, Table 15).

The average share of agriculture in the government budget has never exceeded 10 percent during the postindependence period (Appendix 1, Table 16). This share is small in relation to the size of the population of the farm sector and its contribution to overall output. As a result, the basic infrastructures of agriculture, both hard and soft, have been deteriorating. Much of the existing rural road network has fallen into disrepair, making transportation costly, which has contributed to the declining terms of trade of agricultural products vis-à-vis nonagricultural products in rural areas. Furthermore, efforts to spread output-enhancing technologies among farmers and to improve human resources serving the farm sector (training, research, and extension) have been limited.

Credit policy aimed at both peasant and plantation agriculture is virtually nonexistent. The state-controlled development bank, Société Financière de Développement (SOFIDE), created in 1970, has little room in its policy guidelines for agriculture. Close analysis of the bank policy statement suggests that both the environment and terms under which loans can be obtained exclude most, if not all, peasant farmers, as well as

[23] Ibid.

[24] Banque Nationale du Zaire, *Rapport Annuel 1975* (Kinshasa: Banque Nationale du Zaire, 1976).

many large farmers.[25] Furthermore, the State Agricultural Credit Bank, created in 1983, seems to have adopted the same policy line.[26]

Study Objectives

The effects of all these policies can seldom be determined from statistical records. Nevertheless, this study attempts to analyze the effects of the existing Zairian trade and exchange rate policies on the farm sector. The impact of other economic policies on agriculture is beyond the scope of this study but cannot be ignored.

Several recent studies have shown that trade and exchange rate policies have strong and lasting effects on agriculture through their effects on relative prices and production incentives. These studies indicate that parts of the farm sector have been substantially taxed, both explicitly and implicitly. This growing list of country studies includes those on Nigeria, Argentina, Colombia, and Egypt.[27] Do these conclusions also apply to Zaire?

Trade and exchange rate policies also have serious short- and long-term effects on food consumption through their effects on relative prices of commodities and income distribution. The income loss can be devastating for the poorest groups of the society, which tend to have both large price and income elasticities of demand for high quality foodstuffs.[28] Thus, trade and exchange rate policies are an inextricable part of agricultural production and consumption policies and must be given proportional attention.

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[25] Société Financière de Développement, "Evolution de la Politique d'Intervention de la SOFIDE," Document 315/84/TMV/SAS, Kinshasa, June 20, 1984, p. 19.

[26] Banque du Credit Agricole, "La Politique du Crédit Agricole," paper presented by Deputy Director Ilela, Kinshasa, October 22, 1985.

[27] For Nigeria, see Tshikala B. Tshibaka, "Effects of Nigerian Foreign Trade Policies on the Agricultural Sector, 1955/56-1975/76" (Ph.D. thesis, University of Ibadan, 1979); for Colombia, Jorge García García, *Effects of Exchange Rates and Commercial Policy on Agricultural Incentives in Colombia: 1953-1978*, Research Report 24 (Washington, D.C.: International Food Policy Research Institute, 1981); for Argentina, Domingo Cavallo and Yair Mundlak, *Agriculture and Economic Growth in an Open Economy: The Case of Argentina*, Research Report 36 (Washington, D.C.: International Food Policy Research Institute, 1982); and for Egypt, Grant M. Scobie, *Government Policy and Food Imports: The Case of Wheat in Egypt*, Research Report 29 (Washington, D.C.: International Food Policy Research Institute, 1981).

[28] C. Peter Timmer, "Toward a Nutrition-Oriented Food Policy: The Case of Indonesia," World Bank, Washington, D.C., 1981 (mimeographed).

4

DEFINITIONS AND MEASURES OF AGRICULTURAL PRICE INTERVENTIONS

In this study it is assumed that the Zairian economy is small and open, and that prices, trade regime, and exchange rate policies affect the structure of incentives facing the farm sector and hence agricultural output. This economy produces home, import-competing, and exportable commodities. Home goods include such nontraded farm products as roots, tubers, and plantains. Import-competing goods are made up of farm products such as cereals and industrial consumer goods. The bulk of exportable commodities in Zaire are agricultural and mineral primary products such as coffee, tea, rubber, palm oil, cotton, copper, diamonds, gold, and cobalt. Some are both consumed domestically and exported.

The price data used for this study are severely limited. The Institut National des Statistiques (INS) defines goods on the basis of their origins. Consumer goods are classified as imported, locally produced, and mixed. Imported consumer goods include farm products such as cereals, meat, and dairy products, and nonfarm products such as clothing, shoes, and medicine.

Locally produced consumer goods include both farm and nonfarm products. Among them are home, import-competing, and exportable goods. Among nontradable farm products in the consumer basket are cassava, plantains, and potatoes. Locally produced import-competing commodities include cereals and industrial consumer goods such as clothing, shoes, and soap. Exportable goods are mainly coffee, tea, and palm oil, which compose a small share of the domestic price index of locally produced consumer goods. Most coffee and tea is exported, and the domestic market is quite thin.

Mixed goods include those made from imported and locally produced goods as well as housing and other services. Neither locally produced goods nor mixed goods are a proxy for home goods.

The INS also presents consumer price indexes for food, clothing, housing, and miscellaneous goods. Housing is used in this study as a proxy for home goods since a large share of the cost of housing is made up of home goods such as labor and such building materials as sand, gravel, power, and water. The price of these nontradables is primarily determined by the domestic demand and supply schedules. In addition, the housing price index is based on the Kinshasa metropolitan area, which is taken as representative of the country.

Producer price data also are limited. Exportable crops are generally marketed through official and parallel channels. Crops such as seed cotton that are produced exclusively by peasant farmers have no parallel market. The only outlet for these farmers is the official marketing channels controlled by domestic companies handling the processing of seed cotton. Because most cotton-growing areas are not near the border of the country, smuggling is difficult. In addition, the government has continued to fix the producer price of seed cotton. This exception to the liberalization measures of September 1983 reflects the fact that the domestic cotton market is made up of many producers and few buyers. Therefore, cotton growers continue to bear the full impact of taxation, overvalued exchange rates, and price controls.

To assess the effective impact of the trade regime, exchange rate policy, and other price-distorting policy measures, the weighted average prices paid to palm oil and coffee producers should be computed. This is difficult because the shares of the output of each crop sold in different markets are not known. It is assumed that the prices paid to farmers in local markets (domestic paral-

lel markets) are the most relevant for analysis. All producers have access to domestic parallel markets, whereas official and parallel export markets are limited to a small number of producers who have a high degree of leverage. These prices can be related to the world prices by Cassel's law, or the law of one price, as follows:

$$P_x = P_x^* E_o (1 - t_x)(1 - d_x) = P_x^* E_o T_x, \quad (1)$$

where

P_x = price paid to the exportable crop producer in domestic currency,
P_x^* = exportable crop world price in foreign exchange,
E_o = official exchange rate expressed as a number of units of domestic currency per one unit of foreign exchange,
t_x = export tax,
d_x = domestic parallel market price distortion, and
T_x = price-distorting policy adjustment factor for exports.

The Zairian government does not provide a subsidy to crop exporters.

Most of the output of importable food commodities such as rice and maize is sold in the domestic parallel market, but until September 1983 a limited fraction was sold through officially controlled marketing channels. This was the case for paddy and maize sold to mill owners. Data on imports are available only for crops brought in through official channels. However, it is highly probable that there was underreporting and smuggling. A parallel trade between northern Zambia and the southern part of Shaba Province in Zaire involving maize, flour, sugar, dairy products, eggs, chicken, and other items has been active for many years. It should be emphasized that most food imports, including those going through official channels, continue to be sold in the domestic parallel market. The price paid to farmers in this market is the most relevant and is related to the world price as follows:

$$P_m = P_m^* E_o (1 + t_m)(1 + d_m) = P_m^* E_o T_m, \quad (2)$$

where

P_m = price paid to importable crop producers in domestic currency,
P_m^* = importable crop world price in foreign exchange,
t_m = import tariff rate,
d_m = domestic parallel market price distortion, and
T_m = price-distorting policy adjustment factor for imports.

Introduction of the producer price of nontradables makes the set of prices complete. The structure of relative prices between traded and nontraded commodities is represented by

$$P_x/P_h = (E_o/P_h) P_x^* (1 - t_x)(1 - d_x), \quad (3)$$

$$P_m/P_h = (E_o/P_h) P_m^* \times (1 + t_m)(1 + d_m), \text{ and} \quad (4)$$

$$P_m/P_x = (P_m^*/P_x^*)(1 + t_m) \times (1 + d_m)/(1 - t_x)(1 - d_x). \quad (5)$$

Expressions (3) and (4) show that the real exchange rate (E_o/P_h) plays a crucial role in both export-oriented and import-competing farm and nonfarm activities. The real exchange rate provides a measure of the relative prices of importables and exportables to home goods in the economy.[29] Expression (5) implies that the domestic price of importables relative to exportables

[29] For theoretical details, see Rudiger Dornbusch, "Tariffs and Nontraded Goods," *Journal of International Economics* 4 (May 1974): 177-185; Larry A. Sjaastad, "Commercial Policy, True Tariffs, and Relative Prices," in *Current Issues in Commercial Policy and Diplomacy*, ed. J. Black and B. Hindley (New York: St. Martin's Press, 1980); and Larry A. Sjaastad and K. W. Clements, "The Incidence of Protection: Theory and Measurement," paper presented at the Conference on the Free Trade Movement in Latin America, Hamburg, June 21-24, 1981.

is a function of world prices, trade regime, and other price policy measures.

The lack of data on individual policy variables (t_x, t_m, d_x, and d_m) for Zaire does not allow for a detailed description of how domestic prices were affected over time by these policy variables. Even though the economic history of Zaire gives useful indications of some discrete periods during which severe trade regimes, both in terms of import and export policies, prevailed in the economy, the emphasis as far as describing the movement of domestic prices both in absolute and relative terms will be limited to analyzing the effect of exchange rates on the movement of these prices over time.

Price Intervention and Farm Protection

The extent to which agricultural producer prices differ from corresponding world prices permits inferences about how much domestic agricultural production is protected from foreign competition. One parameter usually considered for this purpose is the effective rate of protection.[30] Where data are limited, as in Zaire, two ratios—the nominal rate of protection and the implicit rate of taxation—computed from price data are generally used as crude measures of protection.

The difference between agricultural producer prices and world prices, expressed as a percentage of world prices (in domestic currency at the official exchange rate) has been widely used in the literature as a nominal rate of protection. This ratio shows the extent to which prices received by farmers have been kept below or above world prices through price-distorting policies. It also indicates the size of the direct taxation of a commodity relative to the world price.

A second crude measure currently used is the implicit rate of taxation or subsidy.[31] This indicator is measured as the wedge between the average price received by local producers and the relevant world price, c.i.f. or f.o.b., depending on whether the commodity is imported or exported, and taking account of an exchange rate adjustment based on purchasing power parity (Appendix 1, Table 17).

The producer wedge is given by:

$$\Delta P = (P^* E_o FPI/CPI) - (P/CPI), \quad (6)$$

where ΔP stands for the producer price wedge in local currency, P^* the world price in foreign exchange, P the local producer price, FPI the consumer price index of Zaire's principal trading partners (the United States, the European Community, and Japan), and CPI the domestic consumer price index. The implicit rate of taxation or subsidy of an individual product would be:

$$\Delta P/(P^* E_o FPI/CPI) = 1 - (P/P^* E_o FPI). \quad (7)$$

This measure of protection is used in this study instead of the nominal rate of protection to assess the extent to which the farm sector is shielded against foreign competition. The implicit rate of taxation as a measure of protection is more preferable than the nominal rate of protection because it takes account of domestic and world inflation.

However, both measures present a number of limitations. They do not account for the effect of commercial policy on the real exchange rate or the changes in terms of trade. They disregard quality differences between the brands of the commodity whose prices are compared. The concepts can only be applied to tradables, hence a whole sector of the economy producing nontradables is not considered. Home goods such as tubers, roots, and plantains constitute an important component of the food basket in Zaire, both in production and consumption. The concepts measure the effects of price intervention only for prices of tradable out-

[30] The effective rate of protection is defined as the value added at the domestic price less the value added at the world price divided by the value added at the world price.

[31] Scobie, *Government Policy and Food Imports in Egypt.*

put and ignore the input side. As a result, they are not adequate measures of the effects of price intervention that occur in both output and input markets. Some of these inputs are used in the production of nontradables. A more appropriate indicator of protection is the effective rate of protection, which cannot be computed at this time because of data limitations.

Despite these limitations, the estimates of implicit rates of protection of the Zairian farm sector are computed and presented in Table 4. The period 1971-82 was marked by the direct intervention of the IMF into the Zairian economy during 1975-79. This was characterized by frequent policy adjustments. For this discussion, 1971-74 and 1980-82 are referred to as the pre- and post-IMF intervention subperiods.

Six crops are considered that were subject to government treatment during the entire period. Three were import-competing crops. Maize was taxed about 2.3 percent during 1971-74 and 27.3 percent during 1980-82 but was protected only 1.1 percent during 1975-79. For all of 1971-82, maize growers sustained an average direct tax of about 12.4 percent per year. In contrast, rice was protected during the entire period. The average direct rate of subsidy to producers was about 32.5 percent during 1971-82. Groundnuts were consistently taxed during the entire period at an average rate of about 38.0 percent. Of the three major food crops, rice was protected, while maize and groundnuts were discriminated against. Groundnut producers bore the highest burden of direct taxation.

For export crops, palm oil production was subsidized at an average annual rate of 51.1 percent during 1971-74 and about 32.5 percent during 1975-79, but was taxed only 16.3 percent during 1980-82. Coffee and cotton were directly taxed during the entire period at average annual rates of 55.1 and 87.7 percent.

The pattern of rates of direct taxation clearly indicate that three major policy reforms occurred during 1971-82. From 1971 to 1974, before IMF intervention, cotton, groundnuts, coffee, and maize were taxed but rice and palm oil were not. Figure 1 (drawn from Appendix 1, Table 18) shows that in the aggregate, exportable crops (coffee, palm oil, and cotton) were taxed slightly more than importable crops but less often.

Table 4—Implicit rates of protection of farm products, five-year averages, 1971-82

Traded Commodity	1971-74	1975-79	1980-82
		(percent)	
Import-competing			
Maize[a]	-2.3	1.1	-27.3
Rice[a]	11.7	65.3	52.3
Groundnuts	-55.9	-39.4	-22.1
Exportable			
Coffee	-40.6	-54.8	-58.2
Palm oil	51.1	32.5	-16.3
Cotton	-82.7	-86.9	-93.0

Sources: Computed from basic data provided by the government of Zaire, particularly the Institut National des Statistiques, Banque Nationale du Zaire, and the Département de l'Agriculture. Other basic data were obtained from the World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984); and the International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984).

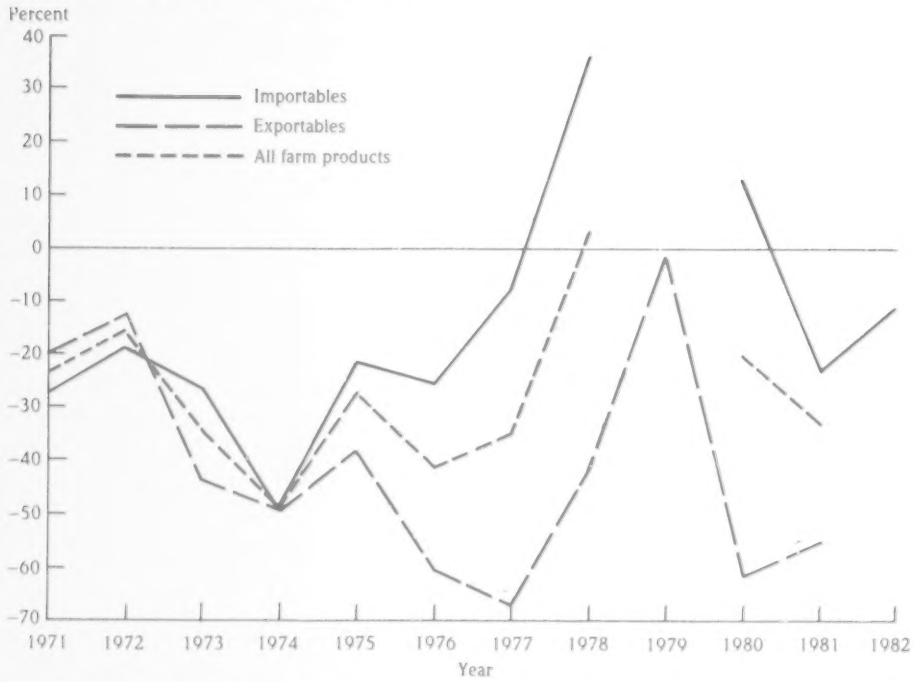
Notes: All the numbers were multiplied by -1. Positive numbers are implicit rates of subsidy. Negative numbers are implicit rates of taxation.

[a] Maize and rice price data for 1979 are not available.

Direct IMF intervention in the economy in 1975-79 coincided with a reversal in government policy. Rice was highly protected, the level of direct taxation of maize production was maintained, and the tax burden on groundnuts was significantly reduced. Rates of taxation of coffee and cotton were increased, while the subsidy rate for palm oil was lowered. Export crops as a group were discriminated against even more during 1975-79 than during 1971-74. Importable food crops were subsidized during 1975-79. During 1980-82, the post-IMF intervention subperiod, the rate of taxation of the export crops was increased, while food crops were no longer subsidized but taxed (Appendix 1, Table 19).

The pattern of government support discriminated against export crops more than food crops during 1971-82. Compared to 1966-70, when output of both groups grew

Figure 1—Implicit rates of protection of importables, exportables, and all farm products, 1971-82



Sources: Computed from basic data provided by the government of Zaire, particularly the Institut National des Statistiques, Banque Nationale du Zaire, and the Département de l'Agriculture. Other basic data were obtained from the World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984); and the International Monetary Fund, *International Financial Statistics, 1983* (Washington, D.C.: IMF, 1984).

rapidly, output of importable crops grew at a slower pace in 1971-82, while export crop output fell (see Figure 2, derived from Appendix 1, Table 20). Expansion of the total output of the six major crops was slow. Figure 2 also reveals impressive growth in the output of selected export crops during 1965-69. This impressive growth could be ascribed to the rehabilitation of the economic infrastructure and activity in Haut-Zaire and Kivu, the major export-crop producing provinces, which were most affected by the civil war.

Domestic Price Movements and Exchange Rate Policy

Two types of price movements are considered here. First, the movements of domestic prices for home, exportable, and importable goods and the exchange rate are described. Second, the way domestic prices of exportables and importables relative to home goods move with the real exchange rate over time is considered.

Figure 3 (drawn from Appendix 1, Table 21) depicts the movements of the domestic price indexes for housing (P_h), exportables (P_x), importables (P_m), and the official exchange rate (E_o). The general consumer price index (CPI) has been added in order to indicate how the real income of producers of different commodities might have been affected. Figure 3 shows that during 1975-82, the domestic price of exportables did not keep pace with the rate of domestic inflation as did the domestic producer prices for im-

Figure 2—Output indexes for major traded farm crops, 1963-81

Sources: Computed from basic data provided by the government of Zaire, particularly the Institut National des Statistiques, Banque Nationale du Zaire, and the Département de l'Agriculture. Other basic data were obtained from the World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1934); and the International Monetary Fund, *International Financial Statistics, 1983* (Washington, D.C.: IMF, 1984).

portables and home goods; this suggests a decline in real income from exportables.

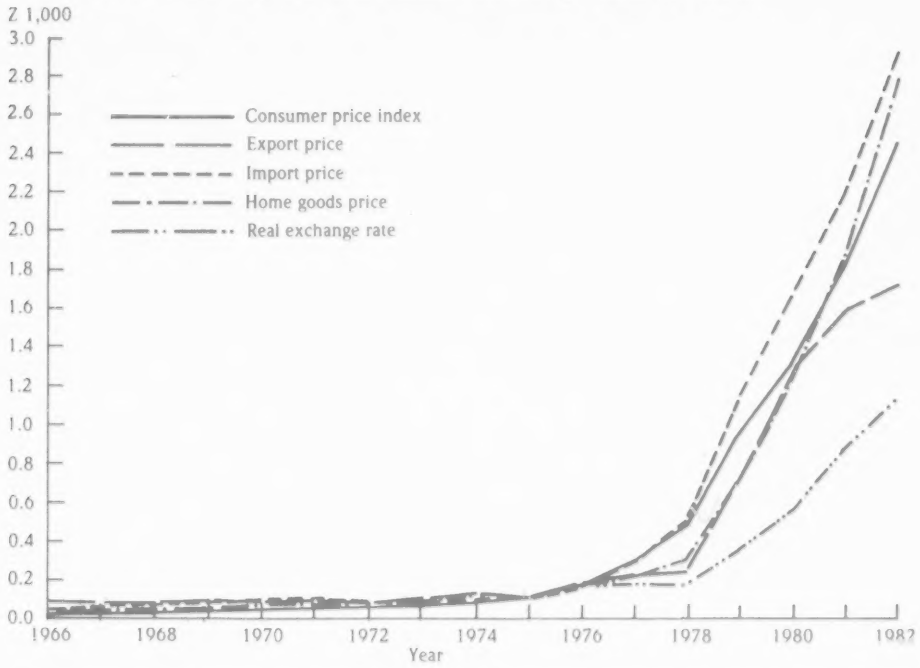
The various adjustment programs implemented with the help of IMF during 1975-79 led to a high rate of inflation. All domestic prices increased at much higher rates than during the previous subperiod. However, the domestic price of exportables increased at a lower rate than other domestic prices, and the official rate of exchange was no longer pegged. The domestic currency was devalued at an average annual rate of 34.3 percent.

From 1980, direct intervention by the IMF apparently ceased. Different domestic prices continued to increase, but at lower rates than in 1975-79, while the rate of devaluation of the domestic currency was higher. However, during the entire period being investigated, domestic currency was being devalued at a lower rate than the increase in the domestic price of nontradables. Table 5 suggests that the trend in the real exchange rate declined. This implies that the relative profitability of exportables was falling.

Importables, followed by home goods, were more profitable than exportables during 1975-79, a period characterized by many policy adjustments initiated with the help of the IMF. The real exchange rate declined at an annual average rate of 8.3 percent during 1975-79 as opposed to annual increases of 4.8 percent during 1966-70 and 0.8 percent in 1971-74.

The real exchange rate improved significantly and increased at a rate of 5.3 percent per year during 1980-82 compared to an

Figure 3—Domestic prices and official exchange rates, 1966-82



Sources: Zaire, Institut National des Statistiques, *Annuaires Statistiques* (Kinshasa, INS, various years); Banque Nationale du Zaire, *Rapport Annuel* (Kinshasa: Banque Nationale du Zaire, various years); and International Monetary Fund, *International Financial Statistics, 1983* (Washington, D.C.: IMF, 1984).

8.3 percent decline during 1975-79. The domestic prices of exportables and importables relative to home goods declined by 13.5 percent and 12.8 percent per year respectively. Figure 4 (derived from Appendix 1, Table 22) shows that the real exchange rate was declining with the domestic price of exportables relative to home goods as opposed to importables.

The situation suggests that importables were increasingly protected relative to exportables. The declining real exchange rate implies that exportables were becoming cheaper to domestic consumers relative to home goods and less profitable for producers. Since exportable commodities are in excess supply in the domestic market and therefore need to be exported, a decline in domestic price relative to home goods will have a limited impact on domestic demand. If both the real exchange rate and the domestic price of exportables continue to decline until sufficient production resources have been shifted to other activities to reduce output, an equilibrium position in the domestic market would be reached. In this case the commodities would no longer be exportable but nontradable. This may be the situation for palm oil. However, if equilibrium is not maintained and excess demand occurs in the domestic market, the once exportable crop could become importable. This is the situation for cotton.

In the medium and long run, however, change in the amount of a given commodity produced not only depends on the change in the relative domestic price of that commodity but also on changes in its domestic and supply schedules, as well as in shift parameters. For instance, if the domestic

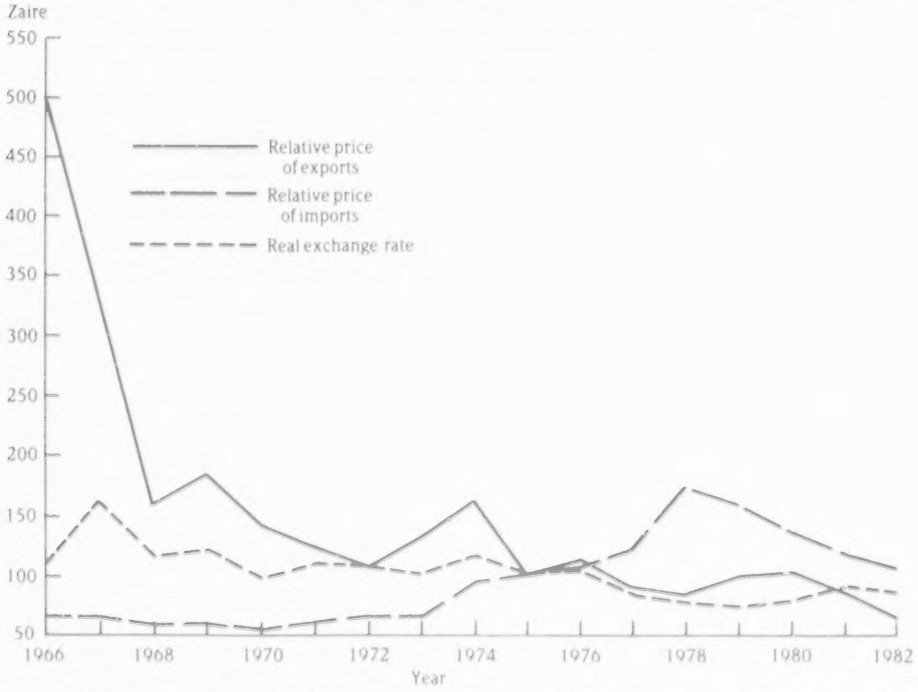
Table 5—Average domestic relative prices and real exchange rates, 1966-82

Period	Relative Price Index for Exportables (P_x/P_h)	Relative Price Index for Importables (P_m/P_h)	Real Exchange Rate Index ([FPI] E_o/P_h)
1966-70	264.6	59.9	120.6
1971-74	130.2	70.8	108.1
1975-79	96.9	132.1	87.2
1980-82	83.5	118.6	84.6

Sources: Computed from basic data provided by the government of Zaire, particularly the Institut National des Statistiques, Banque Nationale du Zaire, and the Département de l'Agriculture. Other basic data were obtained from the World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984); and the International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984).

Notes: P_x stands for the index of the domestic price of exportables, P_m for the index of the domestic price of importables, P_h for the index of the domestic price of nontradables, E_o for the index of the official exchange rate (defined as the number of units of domestic currency per U.S. $1.00), and FPI for the consumer price index for Zaire's principal trading partners (the United States, the European Community, and Japan).

Figure 4—Domestic relative prices and the real exchange rate, 1966-82



Sources: Computed from basic data provided by the government of Zaire, particularly the Institut National des Statistiques, Banque Nationale du Zaire, and the Département de l'Agriculture. Other basic data were obtained from the World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984); and the International Monetary Fund, *International Financial Statistics, 1983* (Washington, D.C.: IMF, 1984).

demand for a commodity rises significantly as a result of rapidly growing population while its supply remains inelastic with respect to its own price, and technological changes in its production are negligible, a rising domestic relative price would not be enough to maintain the commodity on the export list in the medium and long run. The country may eventually find itself a net importer.

A fall in the real exchange rate makes importables cheaper relative to home goods for domestic consumers and less profitable for producers. This creates an excess demand for importables that tends to push up the domestic price. Thus, the real exchange rate may fall over time, whereas the domestic price of importables relative to home goods may continue to rise. Figure 4 illustrates this situation.

The reverse situation may occur. If the real exchange rate increases, importables become expensive relative to home goods for consumers and more profitable for producers. The resulting excess supply tends to push the domestic price of importables downward. In this case the domestic price of importables would decline relative to home goods. However, this situation would quickly change. Resources may move away from importables, so that production would be curtailed, and equilibrium in the domestic market would be achieved. The importables would then become nontraded goods. A second possibility is that government may intervene to avoid further cuts in the domestic price of importables by encouraging the export of the surplus. Then the importables would become exportables.

This discussion shows the centrality of the real exchange rate in moving a product from being an exportable to a home good, and finally to an importable. It explains at least partly the move of Zaire from self-sufficiency in maize and rice at the eve of independence to net importer. The country is no longer an exporter of groundnut oil and cotton but an importer. And it has moved from a position of the second-largest palm oil exporter in the world to that of self-sufficiency. If no substantial policy changes are made, Zaire will, in the near future, be on the list of palm oil importers.

Table 6—Rate of change of real exchange rates, growth rates of farm and gross domestic output, 1966-82

Rate	Recovery Period, 1966-70	Post-Recovery Period, 1971-82
	(percent)	
Rate of change of the real exchange rate	0.8	−0.6
Growth rate		
Major staple food crops	4.0	1.6
Major export crops	8.9	0.8
Gross domestic output	6.4	0.4

Sources: Derived from data in International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984); World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984); and Food and Agriculture Organization of the United Nations, *FAO Production Yearbook*, various issues (Rome: FAO, various years).

Notes: The major staple food crops are maize, rice, sorghum, millet, groundnuts, cassava, sweet potatoes, bananas, and plantains. Major export crops are coffee, palm oil, palm kernels, natural rubber, cotton, and cocoa beans.

The usefulness of the real exchange rate as a policy variable that could easily be monitored by the government is unquestionable. Table 6 shows that farming and overall economic activity in Zaire declined with the real exchange rate during 1966-82. This seems to suggest that to achieve acceptable growth in the economy, the real exchange rate—among other variables—needs to be controlled by the government through suitable fiscal, monetary, income, and other economic policies. The aim would be to maintain the real exchange rate at the level that yielded encouraging performances of the farm and other sectors of the economy in the past.

5

ESTIMATING THE INCIDENCE OF TRADE AND EXCHANGE RATE POLICIES ON RELATIVE AGRICULTURAL PRICES

The basic postulate of the analysis in this chapter is that trade, exchange rate, and other price policies influence the structure of relative prices facing different sectors of the economy and that this determines the allocation of resources within and among sectors. The model developed by Sjaastad helps estimate the incidence of these policies on the structure of relative prices.[32] This analytical framework is being used in a rapidly growing list of trade studies and has been applied to agriculture.[33] Trade, exchange rate, and other price policy variables enter the model through the assumption that excess demand for importables, excess supply for exportables, and excess demand for home goods depend only on relative prices (P_m/P_h, P_x/P_h) and real income.

A distortion, say an import tariff, raises the domestic price to consumers of importables relative to exportables and home goods and makes them relatively more profitable for producers (see Appendix 1, Table 23). This induces consumers to shift their demand from importables to exportables and home goods. It also induces the transfer of resources away from the production of exportable and home goods, which leads to increased domestic production of importables. These processes create a reduction in supply of home goods and an increase in demand. This places upward pressure on the price of nontradables until prices increase to the point at which a new equilibrium is achieved in the home goods market.

The final equilibrium position is such that the import tariff has increased the domestic price of importables relative to home goods, but this increase is less than the full amount of the tariff because the nominal price of nontradables has also risen somewhat.

Instead assume that an export subsidy is given to exportable goods producers. This will increase the domestic price of exportables relative to importables and nontradables. This leads to a contraction of the domestic demand for exportables in favor of importables and nontradables. It also leads to increased production of exportables as resources move away from importables and home goods toward exportables. In the nontradable goods sectors, these processes create a contraction in supply and an expansion in demand, placing upward pressure on the price of home goods until a new supply and demand equilibrium is reached. In the last instance, the price of exportables has increased as well as that of home goods but not to the full extent of the export subsidy.

To formalize these relationships, assume that world prices of tradables are constant, and that the import tariff applied is larger than the export subsidy. Under these assumptions, the equilibrium price in the domestic home goods market will rise by an amount that is less than the import tariff but greater than the export subsidy. Sjaastad has shown that:[34]

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[32] Sjaastad, "Commercial Policy, True Tariffs, and Relative Prices."

[33] García, *Effects of Exchange Rates and Commercial Policy;* Romeo M. Bautista, "Effects of Trade and Exchange Rate Policies on Export Production Incentives in Philippine Agriculture," International Food Policy Research Institute, Washington, D.C., 1985 (mimeographed).

[34] Sjaastad, "Commercial Policy, True Tariffs, and Relative Prices."

$$d_h = s_x + \omega(t_m - s_x), \quad (8)$$

where

d_h = increase in the price of nontradables,
s_x = export subsidy,
t_m = import tariff, and
ω = incidence parameter.

The nominal distortion introduced in the economy by trade policy is measured as the difference $(t_m - s_x)$, which decomposes into two terms:

$$t_m - s_x = (t_m - d_h) + (d_h - s_x). \quad (9)$$

Expression (9) is interpreted as follows: producers in the importable goods sector receive an implicit subsidy given by $(t_m - d_h)$ rather than the nominal import tariff (t_m), whereas producers in the export sector are implicitly taxed to the extent of $(d_h - s_x)$. The size of the total distortion $(t_m - s_x)$ can be determined by policymakers through trade policies, but they cannot decide how this distortion is to be allocated between importables and exportables. This distribution of the distortion between tradable sectors is solely determined by their substitution relationships portrayed by the level of the incidence parameter. For example, if the relationship between home goods and exportables is weak in consumption or production, the value of the incidence parameter will be high. Then from equations (8) and (9) one can see that the implicit subsidy given to producers in the import-competing sector $(t_m - d_h)$ will be much smaller then the implicit tax on producers of exportables $(d_h - s_x)$.

In the case of Zaire, some price distortions due to other price policy measures, along with the export tax, have driven down the producer price for exportables relative to importables and home goods. The demand for exportables in the domestic market rises while production contracts as resources move toward importables and home goods. In the home goods sector, these processes create an expansion in supply and a contraction in demand, placing downward pressure on the price of home goods. This price pressure continues until a new supply and demand equilibrium is achieved at the point where the price of home goods has declined but not to the full extent of the total distortion imposed on export price. These considerations are typical of the Zairian situation.

The above results suggest that the protection of one sector—say, the importable goods sector—causes damage to other sectors. The extent of this damage depends on the degree of substitution between sectors in production and demand. An import tariff meant to protect an import-competing sector may end up being partly or totally transformed into a tax on exportables. An export subsidy may become partly or totally an import subsidy.

It follows from these theoretical developments that a critical parameter to estimate is ω, the incidence parameter. The derivation of this parameter is carried out within the framework of a three-sector model in which general equilibrium is implied by either trade account or equilibrium in the home goods market. It is analytically convenient to use the general equilibrium market clearing properties of the nontradable goods sector to determine the equilibrium price relationship between importables, exportables, and home goods.[35]

Equilibrium in the home goods sector implies that the demand and supply of home goods (D_h and S_h) are equal. Thus,

$$D_h = S_h, \quad (10)$$

where the home goods demand and supply are expressed as

$$D_h = D_h(P_m/P_h, P_x/P_h, Y), \text{ and} \quad (11)$$

$$S_h = S_h(P_m/P_h, P_x/P_h, Z, t), \quad (12)$$

[35] Ibid.

where

P_m = domestic price of importables,
P_x = domestic price of exportables,
P_h = domestic price of home goods,
Y = real income,
Z = vector of productive resources, and
t = technology.

Y, Z, and t can be held constant for the purpose of examining the comparative static properties of the model where the primary interest is the movement of relative prices. Differentiating equations (11) and (12) yields:

$$D_h = \alpha_m(\hat{P}_m - \hat{P}_h) + \alpha_x(\hat{P}_x - \hat{P}_h), \text{ and} \quad (13)$$

$$S_h = \beta_m(\hat{P}_m - \hat{P}_h) + \beta_x(\hat{P}_x - \hat{P}_h), \quad (14)$$

where α_m and α_x stand for elasticities of demand for home goods with respect to the relative prices of importables and exportables; β_m and β_x are the corresponding supply elasticities; and the hat ($\hat{\cdot}$) over the variables indicates a percentage change.

Equating (13) and (14) gives

$$\gamma_m(\hat{P}_m - \hat{P}_h) + \gamma_x(\hat{P}_x - \hat{P}_h) = 0. \quad (15)$$

where $\gamma_m = \alpha_m - \beta_m$ and $\gamma_m = \alpha_x - \beta_x$. Multiplying both sides of expression (15) by -1 gives

$$\gamma_m(\hat{P}_m - \hat{P}_h) + \gamma_x(\hat{P}_h - \hat{P}_x) = 0. \quad (16)$$

The expression (16) can be rearranged, after adding and subtracting $\gamma_m\hat{P}_x$, as follows:

$$\gamma_m(\hat{P}_h - \hat{P}_x) + \gamma_m(\hat{P}_x - \hat{P}_m) + \gamma_x(\hat{P}_h - \hat{P}_x) = 0, \quad (17)$$

so that

$$(\hat{P}_h - \hat{P}_x) = \omega(\hat{P}_m - \hat{P}_x), \quad (18)$$

where ω, which equals $\gamma_m/(\gamma_m + \gamma_x)$ (with $0 < \omega < 1$), is the incidence parameter that determines the induced change in the domestic price of home goods relative to exportables brought about by the change in the domestic price of importables relative to exportables from trade, exchange rate, and other price policy measures. Equation (18) is then rewritten as

$$d\ln(P_h/P_x) = \omega d\ln(P_m/P_x), \quad (19)$$

where dln stands for the derivative of the natural logarithm of the variables in brackets. Assuming constant ω, after integration of equation (19), gives

$$\ln(P_h/P_x) = c + \omega\ln(P_m/P_x), \quad (20)$$

where equation (20) is the basic equation for estimating the numerical value of the incidence parameter ω. Equation (20) may be disaggregated as necessary to take account of several exportable and importable goods subsectors.[36]

It is clear that trade variables (t_m, t_x), the real exchange rate (E_o/P_h), foreign prices (P_m^*, P_x^*), and other price policy variables ($d_{m,dx}$) are brought into the picture in this construction expressing P_h/P_x and P_m/P_x as

$$P_h/P_x = (P_h/E_o)/[P_x^*(1 - t_x)(1 - d_x)] \text{ and} \quad (21)$$

$$P_m/P_x = (P_m^*/P_x^*) \times [(1 + t_m)(1 + d_m)/(1 - t_x)(1 - d_x)] = (P_m^*/P_x^*)(T_m/T_x). \quad (22)$$

The above theoretical development shows how trade, exchange rate, and other price policies affect the structure of relative prices facing the economy through their effect on the domestic prices of tradables.

[36] García, *Effects of Exchange Rates and Commercial Policy.*

Estimation of the Incidence Parameter and the Extent of Taxation

The model for estimating the incidence of commercial and exchange rate policies on the structure of relative prices was based on the assumption that real income, productive capacity (measured by given stocks of capital, labor, and technology), and international prices are constant. In addition, the model assumes that the balance of trade is in equilibrium. Historical data invalidate these assumptions and call for the inclusion of these variables in the regression equations. Hence, real income (Y) as measured by gross domestic product and the balance of trade (BOT) are included as explanatory variables. Finally, government capital expenditures (GIE) and trend (T) are included separately in the model as proxies for change in productive capacity of the economy (exchange in capital stock and technology).

Annual data for 1970-82 are used (see Appendix 1, Table 24). Ordinary least squares techniques performed on small sample data gave error terms that were significantly autocorrelated. The estimation method described by Gallant and Goebel, which Harvey called the two-step full transform method, was used to correct for first autocorrelation.[37] Estimates made from small samples are more efficient when this method is used than with the traditional Cochrane-Orcutt iteration technique. The regression equations are presented in Table 7. The estimates of the incidence parameters are produced for total exports (x), agricultural exports (xa), and nonagricultural exports (nxa). Two variables, the price indexes for housing and cassava, are used as proxies for home goods.

The regression equations using the price index for cassava produced unacceptable results and were rejected. This situation may arise because cassava, a nontradable crop, statistically acts like an importable crop in both production and consumption. As a substitute in consumption, the domestic price of cassava is indirectly affected by the impact of world market conditions on the domestic market of importable crops. That is, if the world price of grain rises, the domestic demand for grains will decline, while that of cassava—a substitute crop—will also rise.

The statistical characteristics for all the regression results are good. The explanatory variables included in the equations explain not less than 90 percent of the total variations in the dependent variables.

The regression coefficients for BOT, GIE, and T are not significant. The estimated coefficients for Y are significant and negative, implying that a positive growth of real income leads, other things being equal, to a decrease in the domestic price of home goods relative to exportables. The explanation is not obvious. The regression coefficient for the price of nonagricultural exports relative to agricultural exports is positive and significant. This implies that the domestic price of home goods is positively and significantly affected by changes in prices of nonagricultural exports relative to agricultural exports.

The estimated numerical values for the incidence parameters are significant for all the categories of tradables and home goods in Table 7. For total exports, estimate of the incidence parameter is about 0.52. In practical terms, the domestic price of home goods relative to exportables would increase by 0.52 percent as a result of a 1 percent rise in the domestic price of importables relative to exportables.

The implication is that a price distortion (from tariffs, quantitative restrictions, domestic pricing and marketing policies, and so forth) that leads to an increase in the domestic price of importables falls partly as a tax on producers of exportables. To illustrate, let us assume that the domestic price of importables has increased 10 percent as a result of the above policies. This represents a tax on exportables of about 5.2 percent. This suggests that, in Zaire, no less than 50 percent of the burden associated

[37] R. A. Gallant and J. J. Goebel, "Nonlinear Regression with Autocorrelated Errors," *Journal of American Statistical Association* 71 (December 1976): 961-967; and A. C. Harvey, *The Econometric Analysis of Time Series* (New York: Halsted Press, 1981), pp. 182-202.

Table 7—Regression results for total, agricultural, and nonagricultural exports, 1970-82

Independent Variable	Dependent Variable: All Exports $\ln P_h/P_x$	Agricultural Exports $\ln P_h/P_{xa}$	Nonagricultural Exports $\ln P_h/P_{nxa}$
Constant	9.079 (3.493)[a]	7.850 (2.655)[b]	7.984 (2.598)[b]
$\ln P_m/P_x$	0.522 (5.017)[a]	...	...
$\ln P_m/P_{xa}$	...	0.407 (3.369)[b]	...
$\ln P_{nxa}/P_{xa}$	...	0.736 (4.606)[a]	...
$\ln P_m/P_{nxa}$	...	...	0.721 (2.234)[a]
$\ln P_{xa}/P_{nxa}$	...	...	0.172 (0.831)
lnY	−2.065 (−3.461)[a]	−1.858 (−2.736)[b]	−1.671 (−2.453)[b]
lnGIE	0.087 (0.865)	0.143 (1.305)	...
BOT	−0.000 (−0.447)	0.004 (1.772)	0.001 (0.365)
T	...	...	−0.029 (−1.017)
R^2	0.904	0.926	0.949
Degrees of freedom	5	4	4

Notes: P_h stands for the index of the price of home goods, P_m for the index of the price of imports, and P_x for the index of the price of exports. P_{xa} stands for the index of the price of agricultural exports; P_{na}, for the index of price of nonagricultural exports. These are mostly minerals, with copper the leading commodity. Y stands for real gross domestic product, GIE for real government capital expenditures, and BOT for the balance of trade. The numbers in parentheses are t-values.

[a] This is significant at the 1 percent level.
[b] This is significant at the 5 percent level.

with the protection of importables is borne by exportables. In addition, if exportables are directly taxed—say, at 15.0 percent—then the total tax rate would be 20.2 percent. In the case of Zaire, however, it is hard to compute the rate of total taxation of exportables because the official rates of import tariffs and export taxes do not reflect smuggling, underreporting, and underinvoicing. The extent of these practices indicates the restrictiveness of the trade regime.

The disaggregation of exportables yields the following estimates of the incidence parameters: 0.407 for agricultural exports and 0.721 for nonagricultural exports. In other words the domestic price of home goods relative to agricultural and nonagricultural exportables would increase by 0.41 and 0.72 percent as a result of a 1 percent rise in the domestic price of importables relative to agricultural and nonagricultural exportables respectively. A comparison of these estimates of the incidence parameter suggests that the largest share of the burden associated with the protection of importables is borne by nonagricultural exports, largely mining.

Implications for Farm Output

The above analysis clearly suggests that trade, exchange rate, and other price policies initiated in Zaire during the period under study have had far-reaching negative effects on exportable goods production. These policies have also tended to reduce substantially the incentive to produce exportables relative to home goods.

Table 1 suggests that during 1971-82, trade, exchange rate, and other price-distorting policies were mostly inward-looking. The output growth rate of importable crops (cereals) that was 1.1 times higher than that of exportable crops during 1966-70 was 3.5 times higher during 1971-82. The annual output growth rate for nontradable food crops such as cassava, sweet potatoes, bananas, and plantains was only one-fourth that of export crops during 1966-70 but was 2.4 times higher during 1971-82. However, the rates of output growth for all three groups of commodities for 1971-82 were significantly less than in the 1966-70 period. Overall, farm output declined because most of the resources diverted from exportable crops moved out of agriculture. Contraction of the export crop sector also led to a reduction in foreign exchange receipts needed to maintain, improve, and expand the productive capacity of the farm sector as well as the economy as a whole. The country became more dependent on mining exports, mainly copper. The limited foreign exchange earnings available tended to be allocated to urban areas to maintain and expand production of import-competing manufactures and to provide socioeconomic services to the urban population at the expense of the rural and farming communities. This left the farm sector unable to meet its import requirements, which helped to slow down its expansion. Furthermore, lack of sufficient foreign exchange earnings limited investments in hard and soft infrastructures that are critical to expansion of the food and export subsectors as well as the rest of the economy.

By discriminating against export activities, economic policies adopted in Zaire have ultimately thwarted the food self-sufficiency objective. Despite protection of importable and nontradable food crops, the country's food supply situation significantly deteriorated during 1971-82. This suggests that policies providing a uniform across-the-board treatment could help improve the production not only of food and export crops but also output in other sectors of the economy.[38]

The tendency to rely mostly on price policies to produce changes in the economy has always been appealing to policymakers in many developing countries, including Zaire. The effectiveness of such price policies depends greatly on complementary resource development policies. Both sets of policies should be considered simultaneously if self-sustained growth of the farm and nonfarm sectors is to be achieved.

[38] Alberto Valdés and Ammar Siamwalla, "Foreign Trade Regime, Exchange Rate Policy and the Structure of Incentives for Agriculture: Essence and Policies," paper presented at the Agricultural Price Policy Workshop, Elkridge, Maryland, April 29-May 2, 1984.

6

THE TRADE-OFF BETWEEN FOOD AND EXPORT CROPS

Per capita food output and the overall standard of living in Africa has been declining since the 1970s.[39] The food supply situation in Sub-Saharan Africa has become a sensitive issue in the international community as well as in Africa. Some observers believe that the emphasis given to export crops in the allocation of public and private resources is the main reason for the poor performance of the food crop subsector in Sub-Saharan Africa. They contend that small peasant farmers, the chief producers of food in most of Sub-Saharan Africa, have little political weight compared to large export-crop growers, which has resulted in a biased allocation of resources. They believe that efforts to improve agriculture should mainly be directed to food production.

Contrary to this line of thinking, a study on Sudan reveals that food-producing activities have little comparative advantage and were heavily protected through exchange rate and trade measures, but export crop production, which has a relatively high comparative advantage, has been discriminated against.[40]

Another view is that expansion of export agriculture is not necessarily harmful to food production. This seems to be supported by the World Bank's 1982 study on Sub-Saharan Africa, which notes that "even if export crop output were to grow at the expense of food crop production, it is not necessarily bad."[41] The study reports that an analysis of FAO data for some 40 African countries shows no positive correlation between strong growth performance in export production and poor performance in food production. The relationship is positive although the correlation is rather weak, a Spearman rank coefficient of 0.42 for the period 1969-71 to 1979.[42]

Several studies on Sudan and Tanzania emphasize the question of economic efficiency regarding food-export crop trade-offs in Africa. Marketing channels for export crops are more developed than those serving food crops. If farmers in some areas specialize in export crop production because conditions are suitable (for example, tree crops in the equatorial forest), they may have serious problems getting food even though their income from exports is relatively high. Largely because of inadequate infrastructure development in food marketing, food prices at the farmer's level may be relatively higher than export crop prices. For these reasons, producers of exportable crops in Tanzania and Ghana, among others, have gone back to food production. In other words, the domestic terms of trade between food commodities and export crops may be worsening for export crop producers. In Zaire, for instance, it is easier to move an export crop to a seaport than to move food items among areas within the country.

Some politicians hold that since conditions are unstable and unpredictable in the world market, it is unwise to depend on it for domestic food requirements. Considerations of economic efficiency and food security may have worked in favor of food self-sufficiency policies.

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[39] World Bank, *Toward Sustained Development in Sub-Saharan Africa: A Joint Program of Action* (Washington, D.C.: World Bank, 1984).

[40] David Franklin, Kirk Youngblood, and Alberto Valdés, "Structure of Incentives for the Rainfed Agricultural Sector in the Sudan," report prepared by Sigma One Corporation, Raleigh, N.C., February 1982 (mimeographed).

[41] World Bank, *Accelerated Development in Sub-Saharan Africa: An Agenda for Action* (Washington, D.C.: World Bank, 1982).

[42] Ibid.

Other economic considerations do not completely support any of the above arguments. A fundamental question facing policymakers in most African countries is: What will happen to the farm sector and the economy as a whole if food crop production is allowed to expand at the expense of export crops in a country where export crop farming is the major source of foreign exchange earnings?

Even in mineral-rich African countries that, like Zaire, do not produce oil, the contribution of agricultural exports to foreign exchange earnings is important, and the need to increase the export base is a real problem. In 1959, when the economic environment was relatively favorable despite the quest for independence, agriculture in Zaire contributed 38.9 percent to total export earnings. This share fell to 16.0 percent during 1971-81, when trade, exchange rate, and other economic policies were inappropriate.

The answer to the question raised above depends in part on whether large-scale farmers shift resources away from export crops into food crop production or into the nonfarm sector when policies that discriminate against exports are implemented by the government. Although not the concern of this study, these issues impinge on the trade-off issue.

Most plantations in Zaire are owned by expatriates or a few rich Zairian families. This is a legacy of Belgian colonization. Under Belgian rule, production of nonfood export crops—raw materials for the metropolitan industry—was stimulated by a number of incentive measures: cheap credit, research, extension, and export and import facilities. Food crop production received relatively little attention from the colonial administration and was left to the Zairian peasants. Twenty-five years after the country gained its independence from Belgium, this dual structure has changed little.

Zairian government policies have tended to be oriented against exports, particularly during 1971-82. This situation has led large-scale farmers to divert most of their resources into nonagriculture, mostly into services, real estate, and speculation. However, these farmers still pay limited attention to livestock, poultry, and pig farming, and in some cases to vegetable farming. These activities have a higher payoff than production of food crops such as cereals, roots, and tubers. It should be stressed that there has been little research on the reaction of large-scale farmers to government policies.

This study examines the question of whether food and export crops compete for resources in peasant agriculture. An aggregate production function used as a tool of analysis would help assess not only changes in the food-export crop mix but also the implications for farm output, food imports, crop exports, farm income, and employment.

Not only are price, input/output, and other relevant data on individual crops needed, but they have to be sufficiently disaggregated by area to permit meaningful analysis based on a production function model. However, the lack of detailed data restricts this analysis to crop supply response, notwithstanding the conceptual and methodological controversies.

Two types of parameters are estimated: own-price and cross-price elasticities of crop output supply. An own-price elasticity indicates the extent to which crop output is affected as a result of a 1 percent change in the crop's own price, whereas the cross-price elasticity gives the impact of a 1 percent change in a competing crop price on the output of the crop. The latter indicates whether there may be a conflict between food and export crops in production. Because of data limitations, this analysis will not be extended to an appraisal of the implications of food-export crop conflict in production for food imports, agricultural exports, farm income, and employment in the peasant sector.

There is little or no literature on supply response studies in Zaire. Bond found none pertaining to Zaire in her extensive review of agricultural responses to prices in Sub-Saharan Africa.[43] As a result, estimates of supply elasticities are attempted for some

[43] E. M. Bond, "Agricultural Responses to Prices in Sub-Saharan African Countries," *IMF Staff Papers* 30 (December 1983).

major crops, notwithstanding serious data limitations and the controversies on the supply response model.

The supply model and the regression equations are reported in Appendix 2. The analysis gives some useful indication of the impact of changes in crop producer prices on crop outputs and mix. This analysis suggests that a change in crop producer prices will have a significant impact on crop outputs, other things remaining the same. Because price intervention policy measures were the main policy devices used by the Zairian government to effect changes in the economy, one can infer that these policy instruments were the most important determinants of the change in crop output. This is because these instruments determine not only the intra- and intersectoral movements of resources, but they also affect the availability of resources such as foreign exchange earnings.

Furthermore, the analysis suggests that food and export crops compete in production. The estimate of the cross-elasticity of palm oil output with respect to the producer price for rice (a competing crop representing food crops) is about −0.453, which is significant and large. This suggests a real conflict between production of palm oil and rice. Considering that groundnuts are not a food crop per se, the supply analysis reveals that the cross-price elasticity of groundnut output with respect to the producer price of maize (representing food crops) is about −0.294. This indicates that groundnuts and maize compete in production.

The response of food output to a change in export crop price appears to be smaller than the response of export crop output to a similar change in the price of food crops. For instance, a 1 percent increase in the cotton price index tends to leave maize output unaffected, but a 1 percent increase in the price index for maize would lead to decreases of 0.135 to 0.190 percent in cotton output. Thus, farmers' response to price changes between food and export crops has been asymmetrical. These results confirm the theoretical proposition that farmers, if their resource endowments are given, would reallocate resources at the margin in favor of the crop whose relative price increases. The difference in the size of the response may be explained by the premium that peasant farmers tend to place on food self-sufficiency.

In sum, the food-export trade-off issue is a real problem in Zairian peasant agriculture. Palm oil competes with food crops in production, as do cotton and groundnuts. The question is whether it is economically efficient and socially sound to adopt trade and exchange rate policies biased more toward staple food crops than to palm oil production in order to boost the production of foodstuffs. Discussion of the above question may not lead to a useful conclusion because palm oil, cereals, tubers, roots, plantains, and bananas are all staple foods in Zaire. Palm oil is the major source of vegetable oil available to the majority of the farming community as well as to a large part of the urban population.

As for cotton and staple food crops such as maize and cassava in cotton-growing areas, policymakers should bear in mind when formulating trade, exchange rate, and other economic policies that a substantial inflow of export earnings is also needed for sustained growth in food production.

Estimates of own- and cross-price elasticities of output supply failed to give acceptable results for coffee, the leading export crop in terms of its contribution to export earnings. Nevertheless, the possibility of conflict between coffee and food crops in peasant agriculture is low in most areas. The bulk of coffee output is produced on large plantations that do not produce food crops. However, in some areas conflict between coffee and food crops in production cannot be ignored. For instance, in Butembo, Lubero, and Beni (Northern Kivu), the production of coffee by peasant farmers is substantial and widespread and may compete with food crops such as beans, potatoes, and vegetables. These are the main food crops traded between the northern part of Kivu region and the rest of the country.

Despite data limitations, it is quite clear that there is a conflict between food and export crops in production in Zaire. A change in the relative prices of these two groups will significantly affect the food-export crop output mix.

7

CONCLUSIONS

Trade, exchange rate, and other economic policies of the Zairian government during the later part of the post-independence era have had pervasive effects on agriculture as well as on the rest of the economy. A comparison of the domestic producer and world prices shows that the importable food crops—taken as a group—and exportable crops were consistently discriminated against. The degree of discrimination varied by crop but was greater for exportable than for importable crops.

The domestic producer prices of food commodities—wage goods—were kept well below the world price as an incentive to import-substitution industrialization. Tax revenue from agricultural and nonagricultural exports (mostly mining) were used, among other things, to expand the productive capacity in the urban area through government investments and to provide cheap credit to industry.

The policy lesson indicated by these developments is that the real exchange rate is one of the critical variables that needs to be monitored by policymakers through fiscal, monetary, income, and other economic policies. The aim should be to maintain the real exchange rate at a level that has yielded encouraging performance of the farm sector and the economy in the past.

Trade, exchange rate, and other economic policies had a substantial impact on the structure of domestic relative prices. The study indicates that a 1 percent rise in the domestic price of importables relative to exportables, as a result of these policies, led to a 0.52 percent increase in the domestic price of home goods relative to exportables. Therefore, at least half of the burden of protecting importables fell on exports (agricultural exports and mining) during 1971-82. This means that a 20 percent increase in the domestic price of all imports represents a 10.4 percent tax on exports. This is in addition to the direct tax levied on exportables. Consequently, the burden imposed on export activities was much heavier than intended by policymakers.

The study indicates that exports with high supply elasticities, such as industrial products, are unable to compete effectively in the world markets. This result is important for the design of overall economic policy. Import-substitution industrialization would jeopardize not only the promotion of agricultural and mineral exports, but also that of industrial exports. Within industry, resources would move away from export activities to import-competing ones. In agriculture, resources would shift out of agricultural exports toward import-competing and home goods production, both agricultural and industrial. Resources used in mining, which in Zaire is almost exclusively for export, would tend to move into industrial import-competing and home goods production.

These resource movements would reduce export activity in the economy and the country would be unable to earn enough foreign exchange to maintain, improve, and expand overall economic activity. Growth of the farm sector and the economy as a whole would decelerate as they did in Zaire during 1971-82.

Comparing 1971-82 with 1966-70, when trade and exchange rate policies were less restrictive, shows that, within the farm sector, rates of growth declined from 4.0 percent to 1.6 percent for food production and from 8.9 percent to 0.8 percent for export production.[44] Meanwhile, the population

[44] The high growth rate for export crop output in 1966-70 should also be ascribed to the rehabilitation of economic activity in the Haut-Zaire and Kivu regions, the two major export crop-producing zones most affected by the Civil War of 1963-65.

grew about 2.8 percent per year.

Clearly, restrictive trade and exchange rate policies do not help improve the country's food self-sufficiency. The study indicates that policymakers should strive for a uniform across-the-board treatment for all tradables if the production of these commodities as well as that of nontradables is to be enhanced.

APPENDIX 1: SUPPLEMENTARY TABLES

Table 8—Growth of food import volume, 1966-82

Year	Total Import Growth	Cereal Import Growth	Other Food Import Growth	Total Food Import Growth
		(percent)		
1966	0.0	0.0	0.0	0.0
1967	-66.7	-39.1	-7.7	-22.4
1968	-20.7	50.2	-6.0	14.7
1969	20.4	-19.1	5.8	-6.2
1970	33.6	31.4	19.6	24.5
1971	19.9	4.8	-10.1	-3.6
1972	-25.9	-8.0	44.4	20.0
1973	21.0	46.6	-8.7	11.5
1974	19.4	36.4	2.7	18.9
1975	-12.8	-40.5	-32.6	-37.0
1976	-24.6	130.9	101.9	116.9
1977	-8.1	-35.7	-64.0	-48.3
1978	-14.1	4.8	45.5	17.5
1979	-4.3	-37.8	-11.0	-27.4
1980	0.1	62.3	-9.0	28.5
1981	-26.0	66.5	-41.4	30.3
1982	-14.8	-44.5	-21.1	-41.0

Sources: Banque Nationale du Zaire, *Rapport Annuel* (Kinshasa: Banque Nationale du Zaire, various years); and Food and Agriculture Organization of the United Nations, "Trade Yearbook Tapes," Rome, various years.

Table 9—Food import bill, 1966-81

Year	Total Import Bill	Food Import Bill			Food Import Bill as Percentage of Total Imports		
		Cereal	Other	Total	Cereal	Other	Total
		(current U.S. $ million)				(percent)	
1966	1,020.0	17.2	19.5	36.7	1.7	1.9	3.6
1967	331.8	10.6	18.3	28.9	3.2	5.5	8.7
1968	292.0	14.9	16.1	31.0	5.1	5.5	10.6
1969	370.0	12.2	17.1	29.3	3.3	4.6	7.9
1970	524.0	17.6	22.7	40.3	3.4	4.3	7.7
1971	666.0	20.0	22.1	42.1	3.0	3.3	6.3
1972	522.0	20.3	35.3	55.6	3.9	6.8	10.7
1973	691.8	35.5	38.4	73.9	5.1	5.6	10.7
1974	954.0	60.0	49.0	109.0	6.3	5.1	11.4
1975	946.2	40.8	37.8	78.6	4.3	4.0	8.3
1976	784.5	95.9	77.7	173.6	12.2	9.9	22.1
1977	807.5	67.0	30.4	97.4	8.3	3.8	12.1
1978	759.6	83.0	52.3	135.3	10.9	6.9	17.8
1979	885.4	59.2	53.1	112.3	6.7	6.0	12.7
1980	1,015.2	84.9	82.1	167.0	8.4	8.1	16.5
1981	832.2	156.9	84.1	241.0	18.9	10.1	29.0

Sources: Banque Nationale du Zaire, *Rapport Annuel* (Kinshasa: Banque Nationale du Zaire, various years); International Monetary Fund, *International Financial Statistics Yearbook, 1984* (Washington, D.C.: IMF, 1985); and Food and Agriculture Organization of the United Nations, *FAO Trade Yearbook*, various issues (Rome: FAO, various years).

Table 10—Sources of food supply, 1966-81

Year	Domestic Food Production	Cereal Food Aid	Commercial Cereal Imports	Total Cereal Imports
		(percent)		
1966	95.5	3.3	1.2	4.5
1967	95.4	2.2	2.4	4.5
1968	96.6	1.4	2.0	3.4
1969	97.0	0.7	2.3	3.0
1970	95.7	0.1	4.3	4.3
1971	95.1	0.5	4.4	4.9
1972	95.3	0.7	4.0	4.7
1973	93.2	0.0	6.8	6.8
1974	93.6	0.0	6.4	6.4
1975	95.6	0.0	4.4	4.4
1976	93.6	0.4	6.0	6.4
1977	94.0	0.5	5.5	6.0
1978	90.8	1.3	7.9	9.2
1979	92.1	1.3	6.6	7.9
1980	92.1	1.4	6.5	7.9
1981	91.1	1.6	7.3	8.9

Sources: Food and Agriculture Organization of the United Nations, "FAO Food Balance Sheets, 1961-65 Average to 1977," Rome, 1978 (computer printout); International Food Policy Research Institute, "Food Aid Tape," Washington, D.C., 1981; and Food and Agriculture Organization of the United Nations, "Trade Yearbook Tapes," Rome, various years.

Notes: Domestic food production includes the production of cereals, roots, tubers, plantains, and pulses (primarily groundnuts). Food exports during the period were nil or negligible.

Table 11—Food import capacity, 1966-81

Year	Total Food Import Bill	Total Value of Export Crops	Total Value of All Exports	Total Food Import Bill as Percentage of Total Value of Export Crops	Total Food Import Bill as Percentage of Total Value of All Exports
			(current U.S. $ million)		
1966	36.7	62.0	424.2	59.2	8.7
1967	28.9	73.9	308.8	39.1	9.3
1968	31.0	80.2	570.2	38.7	5.4
1969	29.3	81.5	680.2	36.0	4.5
1970	40.3	96.0	781.2	42.0	5.2
1971	42.1	34.8	687.0	121.0	6.1
1972	55.6	106.3	737.6	52.3	7.5
1973	73.9	126.7	1,012.8	58.3	7.3
1974	109.0	179.8	1,381.0	60.6	7.9
1975	78.6	100.4	864.8	78.3	9.1
1976	173.6	323.5	867.9	53.7	20.0
1977	97.4	293.2	1,019.1	33.2	9.6
1978	135.3	270.7	772.8	50.0	17.5
1979	112.3	190.9	1,169.6	58.9	9.6
1980	167.0	238.2	2,476.2	70.1	6.7
1981	241.0	182.6	1,889.3	131.9	12.8

Sources: Food and Agriculture Organization of the United Nations, "Trade Yearbook Tapes," Rome, various years; and Banque Nationale du Zaire, *Rapport Annuel* (Kinshasa: Banque Nationale du Zaire, various years).

Table 12—Inflation, exchange rates, and balance of payments, 1966-83

Year	Domestic Consumer Price Index	International Index of Inflation	Official Exchange Rate	Parallel Market Rate	Current Account
			(Z/U.S. $)		(U.S. $ million)
1966	13.3	51.2	0.165	0.647	3.8
1967	18.7	53.3	0.333	0.587	14.4
1968	35.1	55.6	0.500	0.650	50.3
1969	38.2	58.5	0.500	0.626	47.0
1970	45.4	62.0	0.500	0.724	−63.7
1971	47.6	65.7	0.500	0.775	−124.7
1972	55.4	69.5	0.500	0.780	−365.5
1973	64.6	76.1	0.500	0.837	−279.3
1974	77.8	87.9	0.500	0.967	−471.1
1975	100.0	100.0	0.500	1.040	−592.7
1976	188.2	110.0	0.807	2.423	−830.2
1977	307.0	123.2	0.857	3.267	−1,451.3
1978	486.3	134.9	0.836	5.146	−82.8
1979	961.2	150.8	1.729	. . .	−14.9
1980	1,353.2	173.6	2.800	. . .	−1.5
1981	1,813.2	191.7	4.384	. . .	. . .
1982	2,446.9	203.3	5.750	. . .	. . .
1983[a]	4,834.3	209.8	30.000	. . .	. . .

Sources: The domestic consumer price index is derived from data provided by Zaire, Institut National des Statistiques, *Annuaires Statistiques* (Kinshasa: INS, various years). Data for the international index of inflation came from World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984). The official exchange rate is from International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984). The parallel market rate is from *Pick's Currency Yearbook, 1980* (New York: Franz Pick Publishing Co., 1980).

[a] Data for 1983 are as of September 23, 1983. The currency was devalued from 5.750 Z/U.S. $ to 30.00 Z/U.S. $.

Table 13—FAO and Zairian crop export data, 1966-75

Year	Coffee			Cocoa Beans			Natural Rubber		
	FAO	Zaire	Divergence	FAO	Zaire	Divergence	FAO	Zaire	Divergence
					(1,000 metric tons)				
1966	36.0	34.7	1.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1967	43.5	38.2	5.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1968	52.7	53.1	−0.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1969	48.8	48.9	−0.1	4.6	4.3	0.3	n.a.	n.a.	n.a.
1970	58.4	65.0	−6.6	5.0	4.4	0.6	19.0	31.4	−12.4
1971	71.6	71.6	0.0	6.0	6.0	0.0	39.9	39.9	0.0
1972	74.1	74.1	0.0	5.0	6.0	−1.0	37.8	37.7	0.1
1973	55.1	66.9	−11.8	5.2	5.2	0.0	24.7	30.2	−5.5
1974	70.5	77.7	−7.2	4.6	4.7	−0.1	29.3	26.6	2.7
1975	59.4	58.9	0.5	4.9	5.3	−0.4	21.1	24.2	−3.1

Sources: Food and Agriculture Organization of the United Nations, *FAO Trade Yearbook*, various issues (Rome: FAO, various years); and Banque Nationale du Zaire, *Rapport Annuel* (Kinshasa: Banque Nationale du Zaire, various years).

Note: n.a. indicates that data were not available.

Table 14—Government expenditures, 1966-81

Year	Government Surplus (+) or Deficit (−)	Government Expenditures	
		Total	Share in GDP
	(current Z million)		(percent)
1966	−10.1	63	20.7
1967	−5.7	88	18.4
1968	−18.2	140	19.4
1969	0.9	197	22.4
1970	−20.3	266	28.4
1971	−76.2	285	27.2
1972	−81.5	265	22.9
1973	−142.0	312	21.2
1974	−324.4	428	23.8
1975	−214.6	452	23.6
1976	−421.0	555	19.4
1977	−450.4	772	19.5
1978	−595.5	893	16.3
1979	−533.9	1,857	16.7
1980	−237.5	3,391	19.7
1981	−1,332.2	4,190	17.8

Source: International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984).

Table 15—Domestic inflation, money supply, and claims on government, 1966-82

Year	Domestic Inflation		Money Supply		Claims on Government	
	Index	Change	Million Zaires	Change	Million Zaires	Change
	(1975 = 100)	(percent)	(current Z million)	(percent)	(current Z million)	(percent)
1966	13.3	0.0	77.7	0.0	68.6	0.0
1967	18.7	40.6	111.0	42.9	81.0	18.1
1968	35.1	87.7	136.2	22.7	89.8	10.9
1969	38.2	8.8	154.4	13.4	113.0	25.8
1970	45.4	18.8	188.3	22.0	168.8	49.4
1971	47.6	4.8	190.5	1.2	118.1	−30.0
1972	55.4	16.4	235.8	23.8	145.3	23.0
1973	64.6	16.6	294.7	25.0	172.0	18.4
1974	77.8	20.4	394.6	33.9	302.2	75.7
1975	100.0	28.5	462.8	17.3	417.7	38.2
1976	188.2	88.2	680.2	47.0	747.9	79.1
1977	307.0	63.1	1,058.9	55.7	1,104.4	47.7
1978	486.3	58.4	1,651.4	56.0	1,860.9	68.5
1979	961.0	97.6	1,651.9	0.0	2,483.0	33.4
1980	1,323.2	37.7	2,884.9	74.6	2,830.5	14.0
1981	1,813.2	37.0	4,395.6	52.4	4,662.4	64.7
1982	2,446.9	34.9	7,347.2	67.1	8,407.8	80.3

Sources: Zaire, Institut National des Statistiques, *Annuaires Statistiques* (Kinshasa: INS, various years); and International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984).

Table 16—Share of agriculture in the government budget, 1970-81

Year	Current Expenditure	Investment Expenditure	Total
		(percent)	
1970	5.7	3.3	9.0
1971	8.8	3.0	11.8
1972	1.3	3.8	5.1
1973	1.6	1.9	3.5
1974	1.8	3.4	5.2
1975	8.9	3.4	12.3
1976	3.1	7.5	10.6
1977	2.8	2.3	5.1
1978	2.9	15.5	18.4
1979	1.7	9.2	10.9
1980	1.4	13.1	14.5
1981	1.8	3.6	5.4

Source: Unpublished data provided by Zaire, Département de l'Agriculture, Direction des Etudes, Kinshasa, n.d.

Table 17—International price indexes for Zairian imports and exports, 1970-81

Year	Price Indexes		Terms of Trade (Exports/Imports)
	Imports	Exports	
		(1970 = 100)	
1970	100.0	100.0	100.0
1971	111.6	81.9	73.4
1972	125.5	76.5	61.0
1973	156.3	104.6	66.5
1974	204.4	140.0	68.8
1975	260.4	111.2	42.7
1976	469.8	211.6	45.0
1977	572.5	255.8	44.7
1978	672.6	274.9	40.9
1979	1,716.0	784.8	45.0
1980	3,232.8	1,410.4	43.6
1981	4,813.1[a]	1,758.7[a]	36.5[a]

Source: Banque Nationale du Zaire, *Rapport Annuel 1979* (Kinshasa: Banque Nationale du Zaire, 1980), p. 196.

[a] This is an estimate.

Table 18—Implicit rates of protection of farm products, 1971-82

Year	Importables			All Importables	Exportables			All Exportables	All Farm Products
	Maize	Rice	Groundnuts		Coffee	Palm Oil	Cotton		
1971	−5.78	10.57	−51.08	−27.71	−26.01	45.83	−75.62	−20.11	−23.83
1972	−1.68	64.54	−55.95	−18.83	−33.41	121.61	−78.17	−12.73	−15.78
1973	14.31	−8.52	−46.49	−26.74	−49.98	54.11	−87.63	−43.65	−34.86
1974	−16.04	−19.70	−70.01	−48.76	−53.14	−17.28	−89.50	−49.69	−49.15
1975	−1.33	−4.06	−41.15	−21.47	−55.04	2.09	−86.15	−38.15	−27.31
1976	−30.34	28.62	−50.32	−25.77	−81.14	74.60	−85.83	−60.09	−41.21
1977	−2.92	68.39	−44.66	−7.51	−82.58	−21.11	−86.94	−67.30	−35.01
1978	39.10	168.38	−20.49	36.66	−58.96	46.78	−87.65	−42.40	2.66
1979	...	...	−40.30	...	3.78	60.13	−88.12	−1.93	...
1980	−8.97	87.26	−9.48	12.94	−57.51	−25.08	−92.88	−61.58	−20.59
1981	−33.34	16.84	−34.52	−23.38	−49.60	−27.69	−92.31	−55.24	−32.94
1982	−9.52	52.78	−22.37	−11.26	−67.51	3.81	−94.47	...	...

Sources: Computed from basic data provided by the government of Zaire, particularly the Institut National des Statistiques, Banque Nationale du Zaire, and the Département de l'Agriculture. Other basic data were obtained from the World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984); and the International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984).

Notes: All the numbers were multiplied by −1. The negative values are the implicit rates of taxation, whereas the positive ones are the implicit rates of subsidy.

Table 19—Official floor producer prices for major staple food commodities, 1975-81

Year	Maize	Rice
	(Z/metric ton)	
1975	70	80
1976	120	120
1977	120	120
1978	220	160
1979	350	500
1980	500	700
1981	650	800

Source: Unpublished data from Zaire, Département de l'Agriculture, Division d'Etudes et de Programmation, Bureau d'Analyse Economique, Kinshasa, 1982.

Notes: On May 29, 1982, all the farm and nonfarm prices were liberalized.

Table 20—Output indexes for major traded farm crops, 1963-81

Year	Importables	Exportables	Total Farm Output
		(1974-76 = 100)	
1963	39.17	107.28	58.59
1964	36.55	98.46	54.20
1965	36.87	67.07	45.48
1966	48.22	72.84	55.24
1967	52.93	83.20	61.56
1968	59.73	137.82	81.99
1969	65.61	144.36	88.06
1970	86.65	108.24	92.81
1971	89.30	116.27	96.99
1972	92.86	112.19	98.38
1973	95.75	103.61	97.99
1974	97.50	104.33	99.44
1975	100.14	90.23	97.31
1976	102.36	105.45	103.24
1977	104.26	78.59	96.94
1978	103.61	85.39	98.42
1979	108.26	75.84	99.02
1980	113.41	83.66	104.93
1981	119.18	79.80	107.95

Sources: Computed from basic data provided by the government of Zaire, particularly the Institut National des Statistiques, Banque Nationale du Zaire, and the Département de l'Agriculture. Other basic data were obtained from the World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984); and the International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984).

Table 21—Indexes and annual changes of domestic prices and the official exchange rate, 1966-82

Year	Consumer Price (CPI)		Home Goods Price[a]		Exportable Goods Price		Imported Goods Price		Official Exchange Rate	
	Index	Change	Index	Change	Index	Change	Index	Change	Index	Change
	(1975 = 100)	(percent)	(1975 = 100)	(percent)	(1975 = 100)	(percent)	(1975 = 100)	(percent)	(1975 = 100)	(percent)
1966	12.1	0.0	15.4	0.0	77.8	0.0	10.0	0.0	33.0	0.0
1967	16.9	39.7	22.1	43.5	73.5	-5.5	14.3	43.0	66.6	101.8
1968	31.8	88.2	48.1	117.6	77.1	4.9	27.6	93.0	100.0	50.2
1969	34.6	8.8	48.7	1.2	89.7	16.3	28.5	3.3	100.0	0.0
1970	42.8	23.7	63.9	31.2	89.9	0.2	34.6	21.4	100.0	0.0
1971	44.9	4.9	60.3	5.6	73.7	-18.0	36.3	4.9	100.0	0.0
1972	52.3	16.5	65.2	8.1	69.1	-6.2	42.2	16.3	100.0	0.0
1973	69.0	31.9	75.3	15.5	98.7	42.8	49.2	16.6	100.0	0.0
1974	74.5	8.0	76.1	1.1	122.8	24.4	70.8	43.9	100.0	0.0
1975	100.0	34.2	100.0	31.4	100.0	-18.6	100.0	41.2	100.0	0.0
1976	181.2	81.2	171.2	71.2	190.3	90.3	181.7	81.7	161.4	61.4
1977	299.0	65.0	255.8	49.4	230.0	20.1	312.3	71.9	171.4	6.2
1978	476.4	59.3	294.6	15.2	247.2	7.5	512.4	64.1	167.2	-2.5
1979	961.0	101.7	710.0	141.0	705.8	185.5	1,126.1	119.7	345.2	106.5
1980	1,323.1	37.7	1,229.5	73.2	1,268.3	79.7	1,655.5	47.0	560.0	62.2
1981	1,813.2	37.0	1,867.5	51.9	1,589.7	25.3	2,174.0	31.3	876.8	56.6
1982	2,446.9	34.9	2,757.4	47.7	1,717.4	8.0	2,892.6	33.0	1,150.0	31.2

Sources: Zaire, Institut National des Statistiques, *Annuaires Statistiques* (Kinshasa: INS, various years); Banque Nationale du Zaire, *Rapport Annuel* (Kinshasa: Banque Nationale du Zaire, various years); and International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984).

[a] The home goods price index is the series for the consumer price of housing, used as a proxy for home goods.

Table 22—Domestic relative prices and the real exchange rate, 1966-82

Year	Relative Price of Exportables		Relative Price of Importables		Real Exchange Rate	
	Index	Change	Index	Change	Index	Change
	(1975 = 100)	(percent)	(1975 = 100)	(percent)	(1975 = 100)	(percent)
1966	505.2	0.0	64.9	0.0	109.7	0.0
1967	332.6	-34.2	64.7	-0.3	160.6	46.4
1968	160.3	-51.8	57.4	-11.3	115.6	-28.0
1969	184.2	14.9	58.5	1.9	120.1	3.9
1970	140.7	-23.6	54.1	-7.5	97.0	-19.2
1971	122.2	-13.1	60.2	11.3	109.0	12.4
1972	106.0	-13.3	64.7	7.5	106.6	-2.2
1973	131.1	23.7	65.3	0.9	101.1	-5.2
1974	161.4	23.1	93.0	42.4	115.5	14.2
1975	100.0	-38.0	100.0	7.5	100.0	-13.4
1976	111.2	11.2	106.1	6.1	103.7	3.7
1977	89.9	-19.2	122.1	15.1	82.6	-20.4
1978	89.9	6.7	173.9	42.4	76.6	-7.3
1979	99.4	18.5	158.6	-8.8	73.3	-4.3
1980	103.2	3.8	134.6	-15.1	79.1	7.9
1981	85.1	-17.5	116.4	-13.5	90.0	13.8
1982	62.3	-26.8	104.9	-9.9	84.8	-5.8

Sources: Computed from basic data provided by the government of Zaire, particularly the Institut National des Statistiques, Banque Nationale du Zaire, and the Département de l'Agriculture. Other basic data were obtained from the World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1984); and the International Monetary Fund, *International Financial Statistics Yearbook, 1983* (Washington, D.C.: IMF, 1984).

Note: The relative prices of exportables and importables are the ratios of the prices of exportables or importables to the prices of home goods (P_x/P_h, P_m/P_h). The real exchange rate is the ratio of the product of the foreign consumer price index and the exchange rate to the price of home goods ($[FPI]E_o/P_h$).

Table 23—Overall rate of import tariff, selected years

Year	Total Value of Imports	Total Value of Import Duties	Rate of Import Duties
	(Z million)		(percent)
1973	391.0	113.2	29.0
1974	484.0	113.4	23.4
1975	463.5	111.5	24.0
1979	768.0	156.2	20.3
1980	929.4	226.5	24.4

Source: Unpublished data from Zaire, Département de Finance, Direction de l'Informatique, Statistiques de Commerce Extérieur, Kinshasa, 1983.

Table 24—Values of imports and exports of selected agricultural commodities, 1970-82

Year	Maize	Rice	Groundnuts	Coffee	Palm Oil	Cotton
			(Z/metric ton)			
1970	35.10	82.80	114.80	355.36	130.94	302.00
1971	32.31	68.83	124.45	341.47	110.63	359.00
1972	33.74	65.59	130.65	447.30	86.35	379.00
1973	33.34	143.64	196.45	580.55	137.75	621.50
1974	55.56	188.85	303.50	589.94	291.56	650.50
1975	81.08	156.32	226.00	567.18	210.60	577.50
1976	153.33	268.02	342.17	1,542.38	209.82	1,283.04
1977	133.78	321.38	472.29	2,581.97	604.49	1,242.65
1978	133.23	307.49	516.49	1,800.73	433.30	2,401.58
1979	305.89	621.35	976.02	2,581.39	969.05	4,186.00
1980	613.17	1,004.92	1,380.96	6,185.40	1,630.00	8,206.85
1981	915.69	1,655.71	2,788.22	6,210.63	2,149.98	10,033.75
1982	1,081.58	1,882.95	2,325.30	9,084.73	2,212.04	18.676.16

Sources: Zaire, Institut National des Statistiques, *Annuaires Statistiques* (Kinshasa: INS, various years); and World Bank, *Commodity Trade and Price Trends* (Baltimore: World Bank, 1983), p. 78 (groundnuts).

APPENDIX 2: ELASTICITY ESTIMATES OF CROP OUTPUT SUPPLY

It is generally postulated that expected crop producer prices, expected input prices, weather, and technology are the main determinants of the output supply response in agriculture.[45] This general formulation is the basis for estimates of the elasticities of output for selected crops. The particularities of the Zairian farm sector are taken into account.

Available evidence indicates that in the aggregate there is limited use of intermediate inputs such as fertilizers, pesticides, and high-yielding varieties by most Zairian peasant farmers.[46] Consumption of fertilizers in Zaire during 1961/62-1965/66 averaged 0.2 kilograms per hectare of cultivated area compared with 1.2 kilograms per hectare during 1979/80-1981/82.[47] The institutional framework created by the colonial administration through which modern technologies and appropriate techniques of production were to be gradually introduced into the farming sector has been dismantled and has not been replaced by an alternative.[48] To account for the dominant role of labor input in Zairian peasant agriculture, the wage rate is used in the output supply response functions (Tables 25 and 26).

Crop Supply Response Functions

The four crops selected for this analysis include two exportables (cotton and palm oil) and two importables (groundnuts and maize). Results for coffee were not acceptable, probably because of substantial underreporting and smuggling.[49]

Peasant production of palm oil competes for productive resources with that of staple food crops such as maize, rice, cassava, and plantains. The palm oil produced by millions of peasant farmers is assumed to be substantial. Cotton is produced in limited areas in northern and southern regions, where it competes with maize, cassava, and groundnuts.

Groundnuts are mainly produced in the savannah areas, where maize and cassava are the most important competitors. In the northern and southern savannah zones, cassava and maize are cultivated in mixed cropping, whereas cotton and groundnuts are produced as pure crops. In the Zairian Basin, maize, cassava, plantains, and rice are planted in a mixed cropping system by peasant farmers, while palm oil trees are generally cropped alone. All these crops could compete with maize.

The crop supply response equation can be formally written as

$$Q_i = f(P_i, P_c, W, T), \qquad (23)$$

where

Q_i = output index for the crop of concern,

P_i = expected producer price index for the crop of concern,

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[45] S. L. Bapna, *Aggregate Supply Response of Crops in a Developing Region* (New Delhi: Sultan Chand, 1981).

[46] Tshikala B. Tshibaka, "Intensification de l'Agriculture Traditionelle Zairoise: La Contribution des Engrais Chimiques," Université Nationale du Zaire, Campus de Kisangani, Yangambi, 1974 (mimeographed); Tshuinza, "Allocation et Utilisation des Ressources dans l'Agriculture Traditionelle."

[47] These data were provided by Food and Agriculture Organization of the United Nations, *Fertilizer Review, 1982* (Rome: FAO, 1983). Data on fertilizer use per crop are not available. However, the bulk of fertilizer is used in plantation agriculture. A substantial proportion of the fertilizer imported does not reach the farms because it is wasted during distribution, storage, and marketing.

[48] N. M. Kapambwe, "La Relance des Coopératives Agricoles au Zaire: Etude Particulière de la Coopérative des Turumbu," Université Nationale du Zaire, Campus de Kisangani, Faculté des Sciences Agronomiques, Yangambi, 1974 (mimeographed); and Tshikala B. Tshibaka, "Analyse Economique de l'Effet de la Chaux sur la Productivité de Sols Acides," *Annales* (Yangambi: Institut Facultaire des Sciences Agronomiques, 1980).

[49] World Bank, *Country Study: Zaire*, p. 60.

Table 25—Indexes of wages in the private and public sectors, 1971-82

Year	Retail Price Index	Private Sector		Public Sector	
		Nominal Wage Index	Real Wage Index	Nominal Wage Index	Real Wage Index
			(1970 = 100)		
1971	108.1	123.1	113.9	122.5	113.3
1972	122.7	132.0	107.6	130.0	105.9
1973	136.5	132.0	96.7	130.0	95.2
1974	172.5	145.1	84.1	159.9	92.6
1975	227.7	229.7	131.6	180.8	79.4
1976	398.3	364.1	91.4	232.0	58.2
1977	641.5	454.4	70.8	242.0	37.7
1978	1,009.6	595.8	59.0	282.0	28.0
1979	2,131,6	636.9	29.9	579.1	27.2
1980	3,231.3	1,041.9	32.2	671.7	20.8
1981	4,506.9	1,657.5	36.8	831.5	18.4
1982	6,200.0	2,692.3	43.4	1,030.2	16.6

Sources: Banque Nationale du Zaire, *Rapport Annuel 1975* (Kinshasa: Banque Nationale du Zaire, 1976), p. 75; Banque Nationale du Zaire, *Rapport Annuel 1979* (Kinshasa: Banque Nationale du Zaire, 1980), p. 106; Banque Nationale du Zaire, *Rapport Annuel 1982* (Kinshasa: Banque Nationale du Zaire, 1983), p. 96.

P_c = expected producer price index of the competing crop,

W = minimum wage rate index, and

T = trend variable to account for other variables.

Supply refers to the quantities offered for sale in the market at different prices. Total production is treated as the relevant dependent variable. Conceptually, in the most general sense, total production is viewed as total supply in the market, if total demand includes that by farm households.[50]

It is not known exactly how farmers form their expectations of crop prices. The traditional method is to consider last year's prices or sowing time prices as the basis. However, Nerlove argues that estimates of supply response obtained by using last year's

Table 26—Indexes of the legal minimum wage data, 1973-82

Year	Retail Price Index	Nominal Wage Index	Real Wage Index
		(1970 = 100)	
1973	136.5	132.0	96.7
1974	172.5	145.1	84.1
1975	227.7	169.2	74.3
1976	398.3	222.3	55.8
1977	641.5	232.0	36.2
1978	1,009.6	265.8	26.3
1979	2,131,6	355.2	16.7
1980	3,231,3	377.0	11.7
1981	4,506.9	388.5	8.6
1982	6,200.0	442.3	7.1

Sources: Banque Nationale du Zaire, *Rapport Annuel 1979* (Kinshasa: Banque Nationale du Zaire, 1980), p. 106; and Banque Nationale du Zaire, *Rapport Annuel 1982* (Kinshasa: Banque Nationale du Zaire, 1983), p. 96.

[50] Bapna, *Aggregate Supply Response of Crops in a Developing Region.*

prices are underestimated.[51] He claims that farmers take prices of many years into account and that the weight given the price in preceding years declines over time. Although Nerlove's expectation model has been the basis of many supply response studies in the past, it has been questioned by an increasing number of researchers.[52]

Five price expectation models were tried by Bapna in his study of aggregate supply response of crops in India. Two of them were selected for this study. In the first, the farmer expects the last cropping season price to prevail in the current season—the expected price under this model is $P_t = P_{t-1}$. In the second, the farmer assumes a weighted average price for the three years. The weights are 3, 2, and 1. This model seems more relevant to perennial crops such as palm oil trees. The expected price in this case is computed:

$$P_2 = (3P_{t-1} + 2P_{t-2} + P_{t-3})/6. \qquad (24)$$

The traditional approach of considering the preceding year's wage rate is adopted.[53] Producer prices and the wage rate are detrended, using the consumer price index as deflator, to avoid any multicollinearity problem between the trend and other explanatory variables.

Available output and price data constitute an additional problem. For instance, palm oil data refer to the country as a whole and do not distinguish peasant farms and plantations. It is evident that peasant farmers and plantation owners differ in their supply responsiveness to own-price changes and to crop substitution possibilities. A peasant farmer can shift resources from palm oil to rice or maize production much more easily than a palm-oil plantation can. For a peasant farmer, the cross-price elasticity of exportable crop output would be expected to be significantly different from zero, whereas that of export-crop plantations would be zero. Plantations are highly specialized, handling only one crop such as coffee or palm oil. In addition, the supply responsiveness to own-price changes would be greater for a plantation than for a peasant farmer because the latter has many more crop substitution possibilities. The extent of this bias in the regression results is hard to determine. In the case of palm oil, a downward bias in the own-price elasticity estimate and an upward bias in the cross-price elasticity estimate of palm oil output are likely to be introduced. This also will be the case for other crops produced in both peasant and plantation agriculture.

It is not known whether the aggregate producer prices published by Zaire's Department of Agriculture are weighted to take into account the variability of output and prices among crop-producing areas. If the producer prices are not weighted, a bias would be introduced in the values of estimates of parameters of concern. This may be the case for palm oil, groundnuts, and maize. However, cotton prices are the same throughout the country. Although the estimates derived in this study may not be as accurate as would be desired, they do help assess the effects of the policies analyzed.

Results and Discussion

Due to the possibility of a high degree of autocorrelation, particularly when dealing with limited time-series data, the full transform method was used to derive the regression equations for palm oil and other crops.[54] The analysis shows that the output of palm oil is critically determined by the expected producer prices of palm oil and food crops (such as rice) as well as by the expected wage rate.

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[51] Marc Nerlove, *Dynamics of Supply: Estimation of Farmers' Response to Supply* (Baltimore, Md.: Johns Hopkins University Press, 1958), pp. 87-111.

[52] Bapna, *Aggregate Supply Response of Crops in a Developing Region.*

[53] Ibid.

[54] Gallant and Goebel, "Nonlinear Regression with Autocorrelated Errors."

Table 27 presents the regression results for palm oil.[55] In both palm oil equations, the fit is good. The regression coefficients of the explanatory variables have the expected signs and are statistically significant, as indicated by the t-ratios in parentheses, except the wage variable in equation (A) and the trend in both equations. However, given the nature of the palm oil tree, equation (B), in which the three-year average weighted price is used as the expected price, is most appropriate.

The estimate of the palm oil own-price elasticity is 0.566 and is comparable with that reported for palm oil in Nigeria.[56] The estimate of cross-elasticity of palm oil with respect to the producer price for rice is about −0.453. This suggests that there is a conflict between palm oil and rice production. Because rice also represents other food crops, one can infer a trade-off between palm oil and food crops in Zaire. Hence, a change in the domestic producer price of palm oil relative to food crops will significantly affect the production of palm oil.

These empirical results are illustrated in Figure 5 (drawn from Tables 28 and 29), which shows an inverse relationship between palm oil output and the producer price for rice but a positive one between

Table 27—Regression results for palm oil, 1970-82

Independent Variable	Dependent Variable: ln Q Palm Oil	
	Equation A	Equation B
Constant	4.996 (31.341)[a]	4.823 (28.904)[a]
$\ln P_1$ palm oil	0.343 (2.589)[b]	. . .
$\ln P_1$ rice	−0.325 (−2.747)[b]	. . .
$\ln P_2$ palm oil	. . .	0.566 (3.840)[a]
$\ln P_2$ rice	. . .	−0.453 (3.315)[b]
ln Wage	−0.076 (−1.551)	−0.158 (−1.666)[c]
T	−0.918 (−0.511)	−0.011 (−0.221)
R^2	0.99	0.98
ρ	0.029 (0.100)	0.268 (0.923)
Degrees of freedom	6	5

Notes: P_1 stands for the producer price lagged one year (P_{t-1}). P_2 is the weighted average producer price for three years ($[3P_{t-1} + 2P_{t-2} + P_{t-3}]/6$). Q stands for quantity.

The numbers in parentheses are t-values.

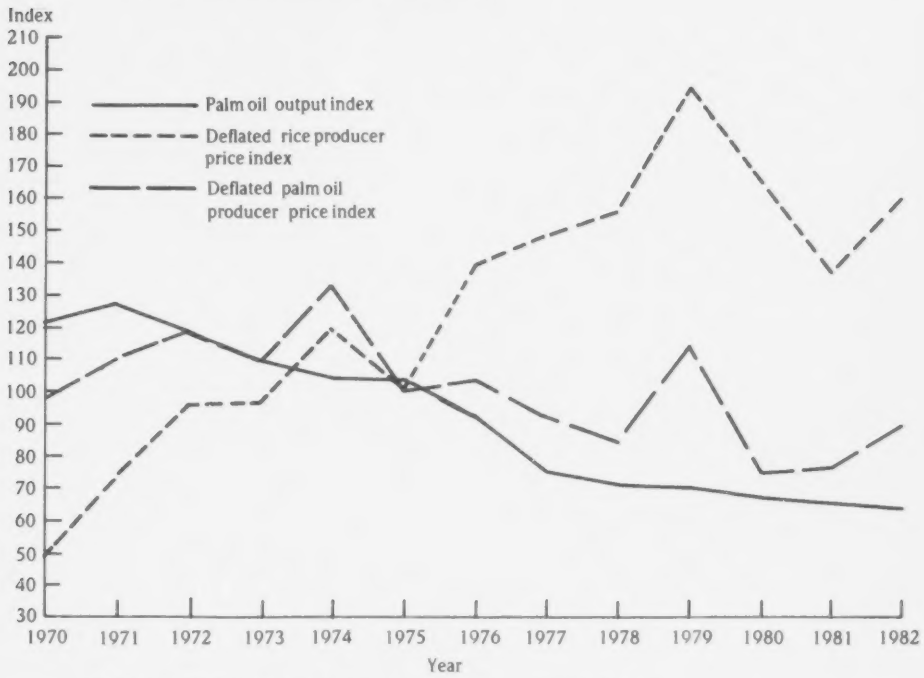
The first step of the two-step full transform method is to estimate the model using ordinary least squares. Then the autoregressive parameter ρ is estimated. The values of ρ are not significant.

[a] Significant at the 1 percent level.
[b] Significant at the 5 percent level.
[c] Significant at the 10 percent level.

[55] In the regression results, P_1 refers to the one-year lagged price, P_2 to the weighted average price, and W_1 to the one-year lagged wage rate.

[56] Bond, "Agricultural Responses to Prices in Sub-Saharan African Countries."

Figure 5—Indexes of palm oil output, and of the deflated producer prices for palm oil and rice, 1970-82



Sources: Calculated from unpublished data provided by the Government of Zaire.

palm oil output and its own-producer price. The figure definitely indicates that there has been a close relationship between palm oil output and producer prices for food crops over the years.

The wage rate is also a critical determinant of palm oil output. The elasticity of palm oil with respect to the wage rate is about −0.158. This suggests that upward pressure on the wage rate will have, other things being equal, a negative effect on palm oil production. This finding offers substantial evidence that rural-urban labor migration, by reducing the supply of farm labor, will exert upward pressure on wage rates and consequently a downward pressure on palm oil output.

The regression coefficients for price variables for cotton displayed the expected signs in all four equations (Table 30). But they are significant in equations (A) and (C) and insignificant in equations (B) and (D), where the trend variable appears as an explanatory variable. The wage rate regression coefficients are insignificant in all four equations. They have the expected sign in equations (A) and (C), where trend is not used as an explanatory variable.

By dropping the trend variable (which represents a proxy for change in productive capacity and technology over time), equations (A) and (C) provide own-price elasticity estimates of cotton output of 1.446 and 1.975. These estimates are rather high and biased, but they appear to be highly significant. The inclusion of the trend variable improved the fit but lowered the t-values of the price elasticities in equations (B) and (D). This could be due to multicollinearity. In any event, an elasticity estimate

Table 28—Average producer's price for major agricultural commodities, 1970-83

Year	Maize	Rice (Milled)	Cassava (Dry)	Groundnuts	Coffee	Palm Oil (Seed)	Cotton
				(Z/metric ton)			
1970	16.00	31.70	9.00	22.00	164.00	90.00	35.00
1971	20.00	50.00	11.00	40.00	166.00	106.00	57.50
1972	23.00	75.00	13.00	40.00	207.00	133.00	57.50
1973	29.00	100.00	16.00	80.00	221.00	162.00	58.50
1974	41.00	133.30	23.00	80.00	243.00	212.00	60.00
1975	80.00	150.00	76.25	133.00	255.00	215.00	80.00
1976	117.50	379.20	175.00	187.00	320.00	403.00	200.00
1977	160.00	666.70	210.00	322.00	554.00	588.00	200.00
1978	250.00	1,113.30	336.00	554.00	997.00	858.00	400.00
1979	1,600.00	2,783.30	1,015.00	2,065.00	4,040.00	2,340.00	750.00
1980	1,160.00	3,266.70	1,290.00	2,170.00	4,563.00	2,120.00	1,014.00
1981	1,170.00	3,708.30	2,020.00	3,500.00	6,000.00	2,980.00	1,480.00
1982	1,330.00	5,833.30	2,000.00	3,670.00	6,000.00	4,670.00	2,100.00
1983	1,600.00	10,666.60	3,650.00	4,500.00	11,000.00	8,483.00	3,500.00

Sources: Unpublished data from Zaire, Département de l'Agriculture, Division des Statistiques Agricoles, Kinshasa, and Zaire, Département de l'Economie Nationale, Conjoncture Economique, Kinshasa.

Notes: The price of paddy has been divided by 0.60 (1 kilogram of paddy gives about 0.60 kilograms of milled rice) in order to get the farm-gate price of milled rice. This transformation has been performed to compare the world market price with the producer price of rice in Zaire. These price data were collected at the village market level.

Table 29—Output of selected major crops, 1963-83

Year	Maize	Rice	Groundnuts	Palm Oil	Coffee	Cotton
			(1,000 metric tons)			
1963	252	60	130	185	49	43
1964	237	55	122	171	44	40
1965	232	49	137	120	30	19
1966	270	91	149	124	37	20
1967	297	100	163	149	37	24
1968	326	117	181	242	63	45
1969	350	130	200	245	68	60
1970	428	179	267	170	59	49
1971	436	184	278	178	65	58
1972	452	196	282	166	68	51
1973	459	199	299	153	57	68
1974	477	201	303	146	69	47
1975	495	207	308	145	51	27
1976	504	212	315	129	89	24
1977	510	218	319	105	56	33
1978	500	225	306	99	77	15
1979	536	223	334	98	60	19
1980	562	240	339	93	74	29
1981	639	245	347	91	71	21
1982	687	251	357	89	68	...
1983	668	258	367	81	63	...

Sources: Zaire, Département de l'Agriculture, Division des Statistiques Agricoles, Kinshasa, unpublished data, 1983; Zaire, Institut National des Statistiques, unpublished data, 1983; and Banque Nationale du Zaire, *Rapport Annuel* (Kinshasa: Banque Nationale du Zaire, various years).

Table 30—Regression results for cotton, 1970-82

Independent Variable	Dependent Variable: ln Q Cotton			
	Equation A	Equation B	Equation C	Equation D
Constant	4.486 (4.772)[a]	3.406 (2.360)[b]	3.801 (3.410)[a]	2.727 (2.350)[b]
$\ln P_1$ cotton	1.446 (1.729)[c]	0.809 (0.839)	...	...
$\ln P_1$ maize	−0.731 (−2.037)[b]	−0.190 (−0.343)	...	...
$\ln P_2$ cotton	...	...	1.975 (1.869)[c]	1.239 (1.223)
$\ln P_2$ maize	...	...	−0.986 (1.994)[b]	−0.135 (−0.280)
ln Wage	−0.809 (−1.032)	0.378 (0.281)	−0.962 (−1.119)	0.839 (0.654)
Trend	...	−0.347 (−1.068)	...	−0.682 (−1.730)[c]
R^2	0.38	0.44	0.41	0.63
ρ	−0.060 (−0.210)	−0.166 (−0.583)	−0.050 (−0.165)	−0.074 (−0.245)
Degrees of freedom	7	6	6	5

Notes: P_1 stands for the producer price lagged one year (P_{t-1}). P_2 is the weighted average producer price for three years ($[3P_{t-1} + 2P_{t-2} + P_{t-3}]/6$). Q stands for quantity.
The numbers in parentheses are t-values.
The first step of the two-step full transform method is to estimate the model using ordinary least squares. Then the autoregressive parameter ρ is estimated. The values of ρ are not significant.

[a] Significant at the 1 percent level.
[b] Significant at the 5 percent level.
[c] Significant at the 10 percent level.

with a wide confidence interval that is unbiased is preferable to a biased one with a high level of significance. Own-price elasticity estimates derived from equations (B) and (D) are respectively 0.809 and 1.239.

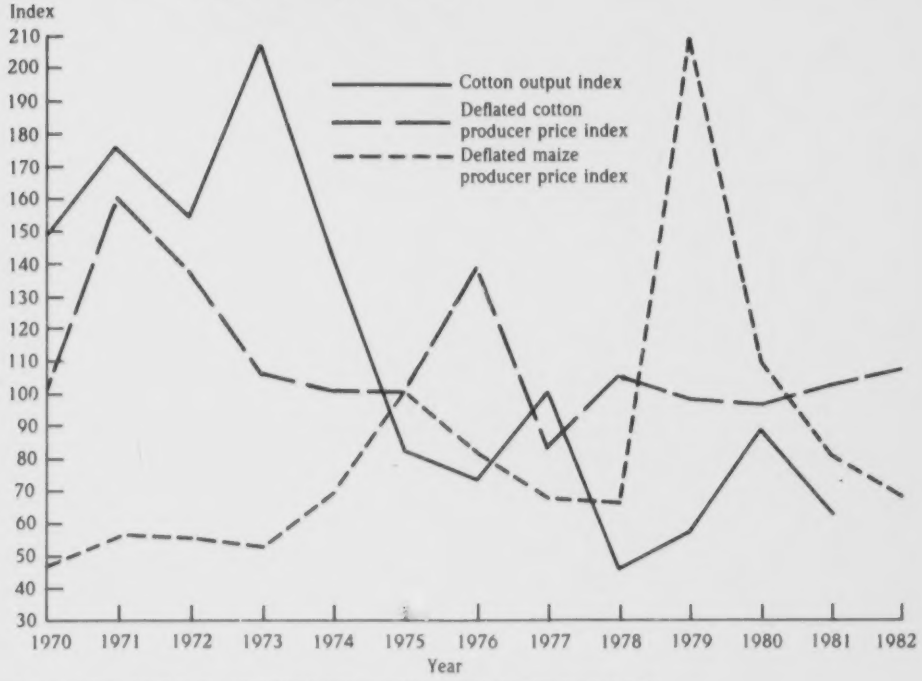
According to Bond, Diejomaoh found that short-run own-price elasticity estimates for cotton output in Nigeria were about 0.67. For Sudan, Bond's estimate of own-price elasticity of cotton output was about 0.39. Two other studies conducted by the same author estimated the own-price elasticity of cotton to be 0.25 for Uganda as a whole and 0.67-0.73 for Buganda/Uganda.[57] These estimates were obtained with a Nerlovian-type model where crop yield was used as a dependent variable rather than total output. Comparison of these elasticity estimates with those in this study could be misleading. However, an own-price elasticity for cotton of about 0.809 could be regarded as acceptable.

The regression results show that maize competes with cotton in production in cotton-growing areas. The cross-elasticity of cotton output with respect to maize price varies between −0.135 and −0.190. The regression results are inconclusive as to the importance of the wage rate variable. This could be because hired labor is seldom used in cotton production.

The direction of the relationships between cotton output, cotton own-producer prices, and maize producer prices is as clear as in the case of palm oil. However, a close observation of Figure 6 shows that cotton output and price both display a declining

[57] Ibid.

Figure 6—Indexes of cotton output, and of the deflated producer prices for cotton and maize, 1970-82



Sources: Calculated from unpublished data provided by the Government of Zaire.

trend over time, suggesting a positive relationship between cotton output and the cotton producer price. However, little can be said about the relationship between maize producer prices and cotton. However, one should note that the cotton producer price continues to be fixed by the government and the same producer price is applied both to northern and southern cotton regions. The producer prices for maize prevailing in these areas differ and do not necessarily reflect the average producer price for maize used in this study, which refers to the country as a whole. A good estimation might have been possible if the producer price for maize prevailing in each cotton-growing area had been available.

All the regression coefficients for groundnuts are statistically significant except the wage rate and the trend variable in equation (A) (Table 31). In addition, the wage rate coefficient in equation (A) is wrongly signed. Equation (B), having weighted expected prices (P_2 groundnuts and P_2 maize), seems to describe the groundnut supply response much better than that using one-year lagged prices as expected prices (P_1 groundnuts and P_1 maize). Hence, the groundnut equation (B) will be used to derive the estimates of output elasticities with respect to crop prices and the wage rate.

The own-price elasticity of output for groundnuts is about 0.544. This is comparable to the result derived for Nigeria. Bond reports that Olayide found own-price elasticity of output for groundnuts in Nigeria within the range of 0.24 and 0.79 determined by Bond.[58] The cross-elasticity of

[58] Ibid.

Table 31—Regression results for groundnuts, 1970-82

Independent Variable	Dependent Variable: Q Groundnuts	
	Equation A	Equation B
Constant	94.486 (9.572)[a]	81.365 (9.391)[a]
P_1 groundnuts	0.034 (3.241)[b]	...
P_1 maize	−0.026 (−3.086)[b]	...
P_2 groundnuts	...	0.104 (6.073)[a]
P_2 maize	...	−0.076 (−5.532)[a]
Wage	0.018 (0.859)	−0.081 (−2.870)[b]
Trend	0.109 (0.099)	2.278 (2.281)[b]
R^2	0.98	0.99
ρ	0.253 (0.905)	0.392 (1.415)
Degrees of freedom	6	5

Notes: P_1 stands for the producer price lagged one year (P_{t-1}). P_2 is the weighted average producer price for three years ($[3P_{t-1} + 2P_{t-2} + P_{t-3}]/6$). Q stands for quantity.

The numbers in parentheses are t-values.

The first step of the two-step full transform method is to estimate the model using ordinary least squares. Then the autoregressive parameter ρ is estimated. The values of ρ are not significant.

[a] Significant at the 1 percent level.
[b] Significant at the 5 percent level.

groundnut output with respect to the maize price is −0.294, suggesting that there is a conflict in production between groundnuts and maize in groundnut-growing areas. The elasticity of groundnut output with respect to wage amounts to −0.127. In sum, both a change in the groundnut producer price relative to maize and a change in the wage rate will have significant effects on groundnut output. Figure 7 further illustrates these findings and discloses the strong relationships between groundnut output and groundnut and maize producer prices over time.

In Table 32, equations (A), (B), and (C) for maize have their maize price regression coefficients wrongly signed; only equation (D) is significant. The regression coefficients for cotton price display the wrong sign in equations (A) and (C), where the trend is used as an additional explanatory variable. Because of poor results, all four equations could not be used to estimate the price elasticities of maize output.

Nevertheless, equation (D) could be used to estimate the elasticities of maize output. However, this estimate will be biased because the time variable that also explains the variation in output is dropped. The own-price elasticity of maize output estimated from this equation is about 0.121. Using different model specification, Oyejide found that the elasticity of maize output with respect to its own price to be about 0.25 in Nigeria.[59]

The cotton price regression coefficient in equation (D), although insignificant, is

[59] T. Ademola Oyejide, *The Effects of Trade and Exchange Rate Policies on Agriculture in Nigeria*, Research Report 55 (Washington, D.C.: International Food Policy Research Institute, 1986).

Figure 7—Indexes of groundnut output, and of the deflated maize producer prices for groundnuts and maize, 1970-82

Sources: Calculated from unpublished data provided by the Government of Zaire.

negative, suggesting a possible conflict between maize and cotton in production. Because the regression coefficient for the price of cotton is not statistically different from zero, one could infer that a change in the price of cotton does not present a real threat to maize production. Unlike maize, cotton is marketed in Zaire through official channels, which are poorly organized and unreliable. Farmers may not be prepared under these conditions to significantly curtail the production of maize, a secure source of cash income, even if the relative prices favor cotton. This explains at least partly why the cotton producer price is not a significant variable affecting maize output in Zaire.

Figure 8 shows increasing trends in both output and producer prices for maize during 1970-82. While the cotton producer price was declining, maize output was increasing but at a moderate rate. Figure 8 indicates a somewhat close relationship between maize output and maize and cotton producer prices. The regression analysis, however, does not forcefully bring out these relationships.

Table 32—Regression results for maize, 1970-82

Independent Variable	Dependent Variable: Q Maize			
	Equation A	Equation B	Equation C	Equation D
Constant	73.501 (16.849)[a]	101.821 (29.204)[a]	70.119 (4.790)[a]	96.077 (30.763)[a]
P_1 maize	−0.018 (−4.876)[a]	−0.011 (−1.448)	...	...
P_1 cotton	0.073 (6.532)[a]	−0.068 (−2.598)[b]	...	...
P_2 maize	...	...	−0.025 (−0.921)	0.022 (1.739)[c]
P_2 cotton	...	...	0.105 (1.429)	−0.018 (−0.444)
Wage	−0.130 (−5.713)[a]	−0.106 (−2.019)[b]	−0.153 (−1.344)	−0.040 (−0.689)
Trend	2.981 (6.547)[a]	... ...	3.330 (1.879)[c]	... ...
R^2	0.95	0.89	0.96	0.96
ρ	−0.075 (−0.261)	−0.300 (−1.091)	−0.027 (−0.089)	0.290 (1.004)
Degrees of freedom	8	5	7	6

Notes: P_1 stands for the producer price lagged one year (P_{t-1}). P_2 is the weighted average producer price for three years ($|3P_{t-1} + 2P_{t-2} + P_{t-3}|/6$). Q stands for quantity.

The numbers in parentheses are t-values.

The first step of the two-step full transform method is to estimate the model using ordinary least squares. Then the autoregressive parameter ρ is estimated. The values of ρ are not significant.

[a] Significant at the 1 percent level.
[b] Significant at the 5 percent level.
[c] Significant at the 10 percent level.

Figure 8—Indexes of maize output, and of the deflated producer prices for maize and cotton, 1970-82

Sources: Calculated from unpublished data provided by the Government of Zaire.

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